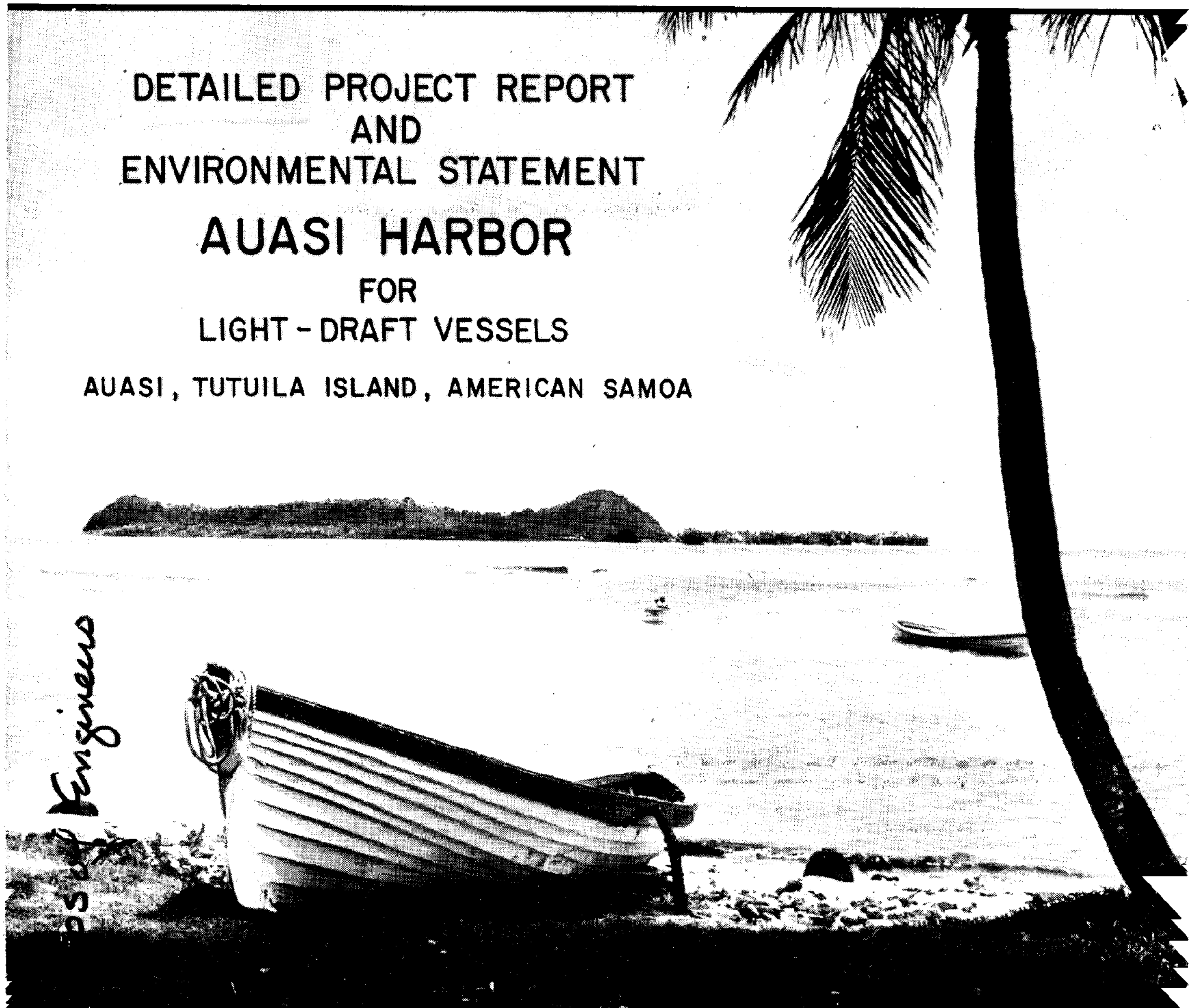
DRAFT

DETAILED PROJECT REPORT
AND
ENVIRONMENTAL STATEMENT
AUASI HARBOR
FOR
LIGHT-DRAFT VESSELS

AUASI, TUTUILA ISLAND, AMERICAN SAMOA



U.S. Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, HONOLULU
SEPTEMBER 1977

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DRAFT
DETAILED PROJECT REPORT
AUASI HARBOR
FOR LIGHT-DRAFT VESSELS
AUASI, AMERICAN SAMOA

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THE STUDY AND REPORT

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SECTION A

THE STUDY AND REPORT

PURPOSE AND AUTHORITY

1. The purposes of this study were to determine the feasibility of providing a safe and efficient means of transporting people and goods between the Auasi area on the southeast end of the island of Tutuila and the island of Aunu'u, and to determine the extent to which the Federal Government can participate in the construction of the recommended solution.

2. This study results from a request by the Government of American Samoa (GAS) in October 1969 for assistance in developing a badly needed transportation system for the island territory. A reconnaissance report indicating the feasibility of constructing a harbor at Auasi and recommending detailed studies was completed in 1970. At that time, GAS asked that further evaluations be undertaken under the survey authority, General Investigation appropriation. By letter dated 16 October 1975, GAS requested that the detailed study for Auasi now be made under Section 107 authority. Preparation of a Detailed Project Report for Auasi Small Boat Harbor was approved in December 1975, and funds to initiate detailed studies were received in November 1976.

SCOPE OF THE STUDY

3. The study focused on the identification and evaluation of the problems attending navigation in the Auasi area of the island of Tutuila, and the need for navigation improvements. The problems and needs were summarized in planning objectives to guide the study. Alternative improvement plans were developed to meet the planning objectives. The costs, benefits, and environmental impacts associated with implementing the alternative plans were determined, and the plans evaluated to determine which plan would best meet the planning objectives as well as being compatible with the overall needs and resources of the study area.

4. The study area was limited to the area of Auasi village, between Taugamalama Point on the west and Maatulaumea Point on the east. This is the traditional landing place for persons traveling betwen Tutuila Island and Aunu'u Island, and has resulted in the close ties between the people of Aunu'u and the village of Auasi necessary for development of a harbor which will primarily benefit the people of Aunu'u Island. In addition, Auasi is the closest landing for persons coming from Aunu'u, and is straight across the channel between the two islands from the authorized Aunu'u Small Boat Harbor.

5. Studies conducted during the preparation of this report include detailed site investigations, topographic and bathymetric surveys, oceanographic analysis to determine the design criteria, and preliminary engineering design, economic evaluations, and environmental assessment. A detailed marine environmental survey and an archaeological reconnaissance study were accomplished to aid in the impact assessment and evaluation and the preparation of an environmental statement.

6. The study has been conducted in sufficient depth and detail to define the navigation need and the planning objectives, and to develop and assess alternative plans for public review and comment.

STUDY PARTICIPANTS AND COORDINATION

7. The U.S. Army Corps of Engineers, Honolulu Engineer District, is responsible for conducting and coordinating the study and preparing the report. The studies and investigations were performed with the assistance of the GAS Department of Public Works.

8. Information and comments received from the following agencies and individuals were considered in identification of problems and needs and development of alternative plans:

Departments of the Government of American Samoa
Chiefs of Auasi and Aunu'u Villages
Sa'ole County Officials
National Marine Fisheries Service
US Fish and Wildlife Service

9. Meetings were held on 16 December 1976 and 21 April 1977 with representatives of Auasi and Aunu'u villages to aid in determining the problems and needs for navigation improvements and the desires of the local communities. A formal public meeting is scheduled for October 1977.

PRIOR STUDIES AND REPORTS

10. The development of a system of harbors to link the islands of American Samoa is part of the Government of American Samoa's effort to upgrade the territory's infrastructure. Detailed project reports for harbors on the islands of Ofu, Ta'u and Aunu'u were completed by the Corps of Engineers in January 1973, July 1974, and September 1975, respectively. Construction of the Ofu Small Boat Harbor was completed in 1976, and the harbor on Ta'u is under construction. Except for the reconnaissance report prepared by the Corps of Engineers in January 1970, there are no reports on harbor development for the Auasi area.

SECTION B

RESOURCES AND ECONOMY OF THE STUDY AREA

SECTION B

RESOURCES AND ECONOMY OF THE STUDY AREA

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SECTION B

RESOURCES AND ECONOMY OF THE STUDY AREA

GENERAL DESCRIPTION

TERRITORY OF AMERICAN SAMOA

1. American Samoa is a group of seven islands, five volcanic islands and two coral atolls, located in the South Pacific at about 170° west longitude and 14° south latitude. These islands, which comprise a total of 76 square miles, are about 2,300 nautical miles southwest of Hawaii (Figure B-1).

2. The five volcanic islands which are also the major inhabited islands of American Samoa are Tutuila, Aunu'u, Ofu, Olosega, and Ta'u. Tutuila, the largest and principal island, is the center of Government and business. Aunu'u, a satellite of Tutuila, lies one mile off the southeast coast of Tutuila. The three islands of Ofu, Olosega, and Ta'u, collectively referred to as the Manu'a Islands, lie 66 miles east of Tutuila.

3. The Chiefs of Tutuila and Aunu'u ceded title to the United States in 1900, and Ta'u, Olosega, and Ofu followed in 1904. From 1900 to 1951, the U.S. Navy administered the islands as a territory of the United States. In 1951, administration was transferred to the U.S. Department of the Interior. American Samoa remains an unorganized, unincoporated territory of the United States.

STUDY AREA

4. The study area is located at the village of Auasi, on the southeast end of Tutuila, approximately 15 road miles from Pago Pago Harbor. (See Plate 1). Pago Pago Harbor, which nearly bisects the island, is the major commercial and industrial center in American Samoa. The village of Auasi is located in a shallow bay between Taugamalama Point and Maatulaume Point, and is the traditional landing point for the residents of Aunu'u Island who commute to and from Tutuila. Approximately 100 to 150 persons living on Aunu'u commute daily by longboat to Auasi to go to school, work, and the markets in Pago Pago. There is only an elementary school on Aunu'u, and no employment opportunity, hence, students must commute to the Western Region High School and the community colleges on Tutuila, and workers commute to jobs with GAS and at the tuna canneries in Pago Pago. In addition, agricultural products such as taro, breadfruit, and citrus fruits are transported daily to the markets in Pago Pago. At the present time, the only daily transportation between Aunu'u and Auasi is by longboat and small outboard motor boats.

NATURAL FORCES

WINDS

5. The prevailing winds throughout the year are the easterly trades. They tend to approach Samoa more directly from the east during December through March, but predominatly from east-southeast and southeast during the rest of the year. The wind diagram (Figure B-2) was prepared from data obtained from a wind gage at Pago Pago International Airport, Tutuila, American Samoa.

TIDES

6. There are no tide gages at Auasi. Because of its proximity to Pago Pago, the tidal data for Pago Pago Bay are considered applicable to Auasi. The tidal data shown below were obtained from the U.S. Coast and Geodetic Survey and are referenced to mean low water (MLW). Two high and two low tides occur daily. The mean and spring ranges for Pago Pago Bay are 2.5 and 3.1 feet, respectively.

	Pago Pago
Mean High Water	2.5 feet
Mean Tide Level	1.2 feet
Mean Low Water	0.0 feet
Lowest Tide Expected	-2.0 feet

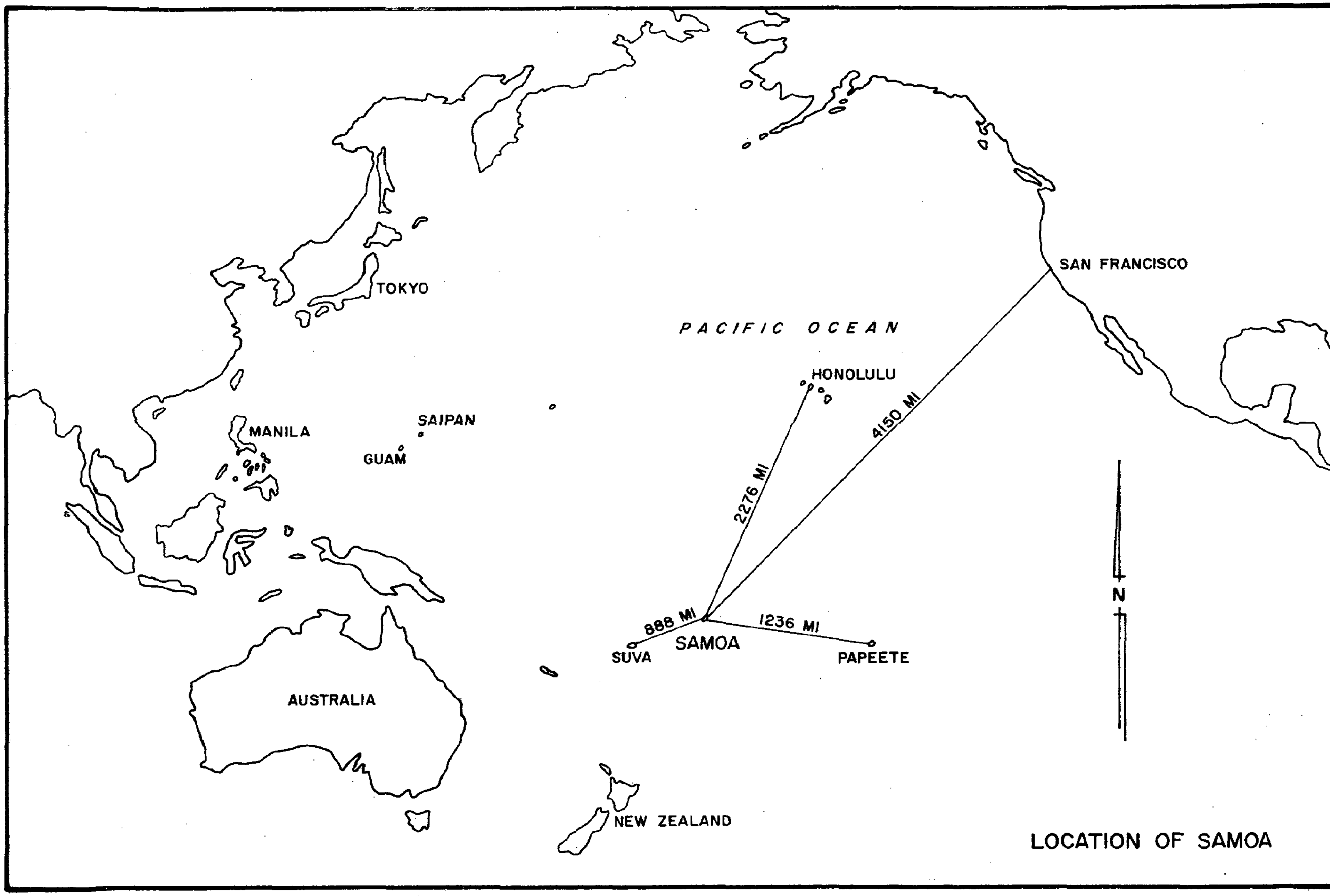
WAVES

7. Data from the U.S. Navy's sea and swell charts indicate that from June through November, approximately 80 percent of the waves are from the east and southeast. For the rest of the year, approximately 75 percent of the waves are from the northeast, east, and southeast. Thus, the dominant wave pattern is that caused by the easterly trades. Table B-1 shows the results obtained from analyzing the histograms of the U.S. Navy's chart.

8. Figure B-3 shows the exposure of Auasi to deep ocean waves. The Auasi coastline is protected from waves approaching from the west clockwise to the northeast by the Tutuila Island landmass. It is also protected from the southeast by the Aunu'u Island landmass. Waves approaching from the east are greatly attenuated by divergence as they retract around the east end of Tutuila.

STORMS AND HURRICANES

9. Samoa lies across the path of hurricanes which move into the area generally from the north but occasionally from the east, southeast, or west. According to one compilation, Samoa experienced at least 34 hurricanes between 1831 and 1923. According to another compilation, American Samoa experienced at least five "true" hurricanes between 1913

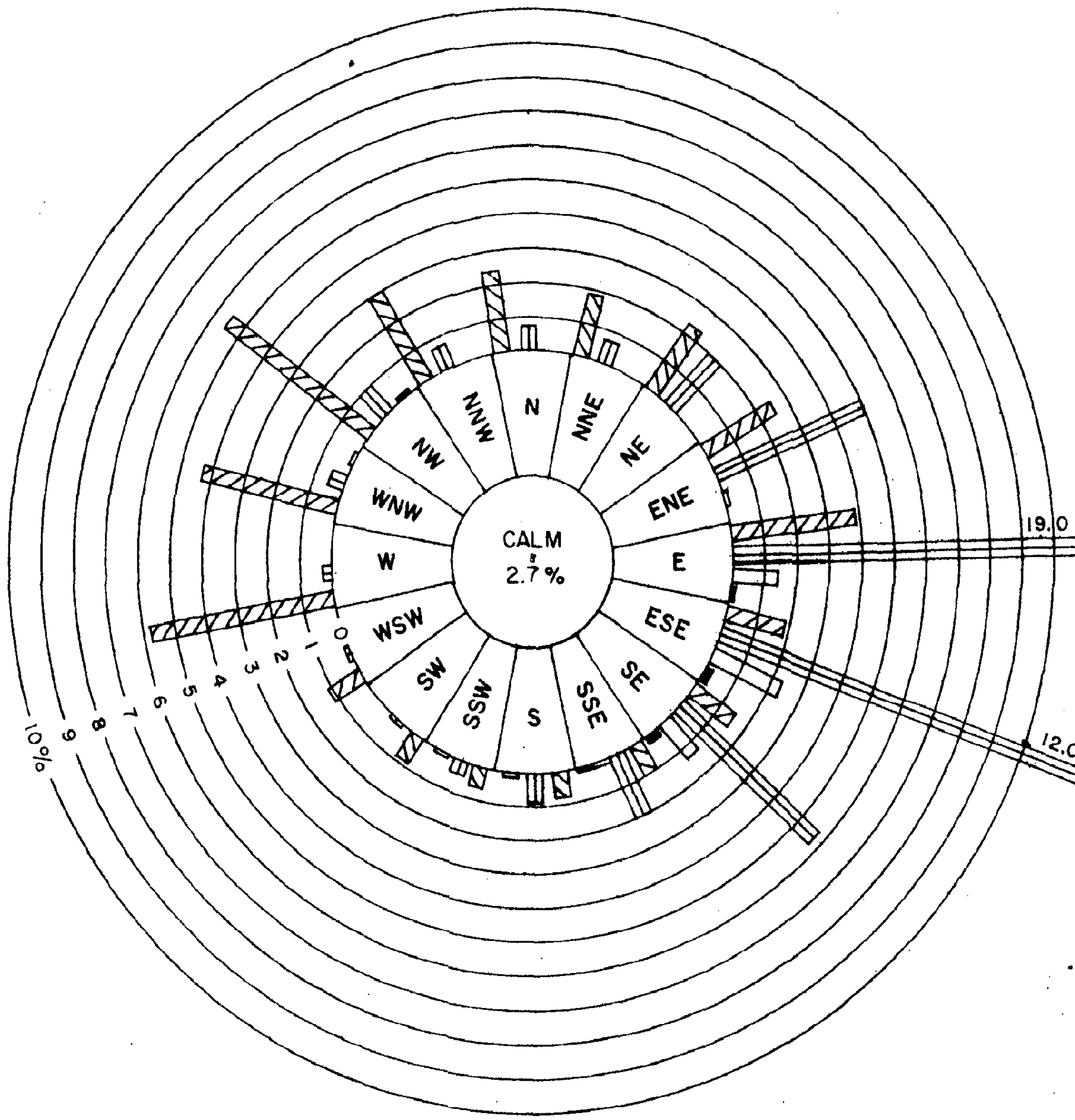


LOCATION OF SAMOA

FIGURE B-1

FIGURE B-1

SURFACE WIND DIAGRAM
PAGO PAGO INTERNATIONAL AIRPORT
TUTUILA, SAMOA ISLANDS



LEGEND

1 - 6 KNOTS

7 - 16 KNOTS

17 - 21 KNOTS

OVER 21 KNOTS

CONVERSION : 1 KNOT = 1.1516 MPH

10% = TOTAL % OF THE YEAR

PERIOD OF RECORD

1945 - 1968

SOURCE

NATIONAL WEATHER SERVICE
HONOLULU, HAWAII
DATA COMPILED BY U. S. AIR FORCE
ENVIRONMENTAL TECHNICAL
APPLICATION CENTER,
ASHEVILLE, N. C.

FIGURE B-2

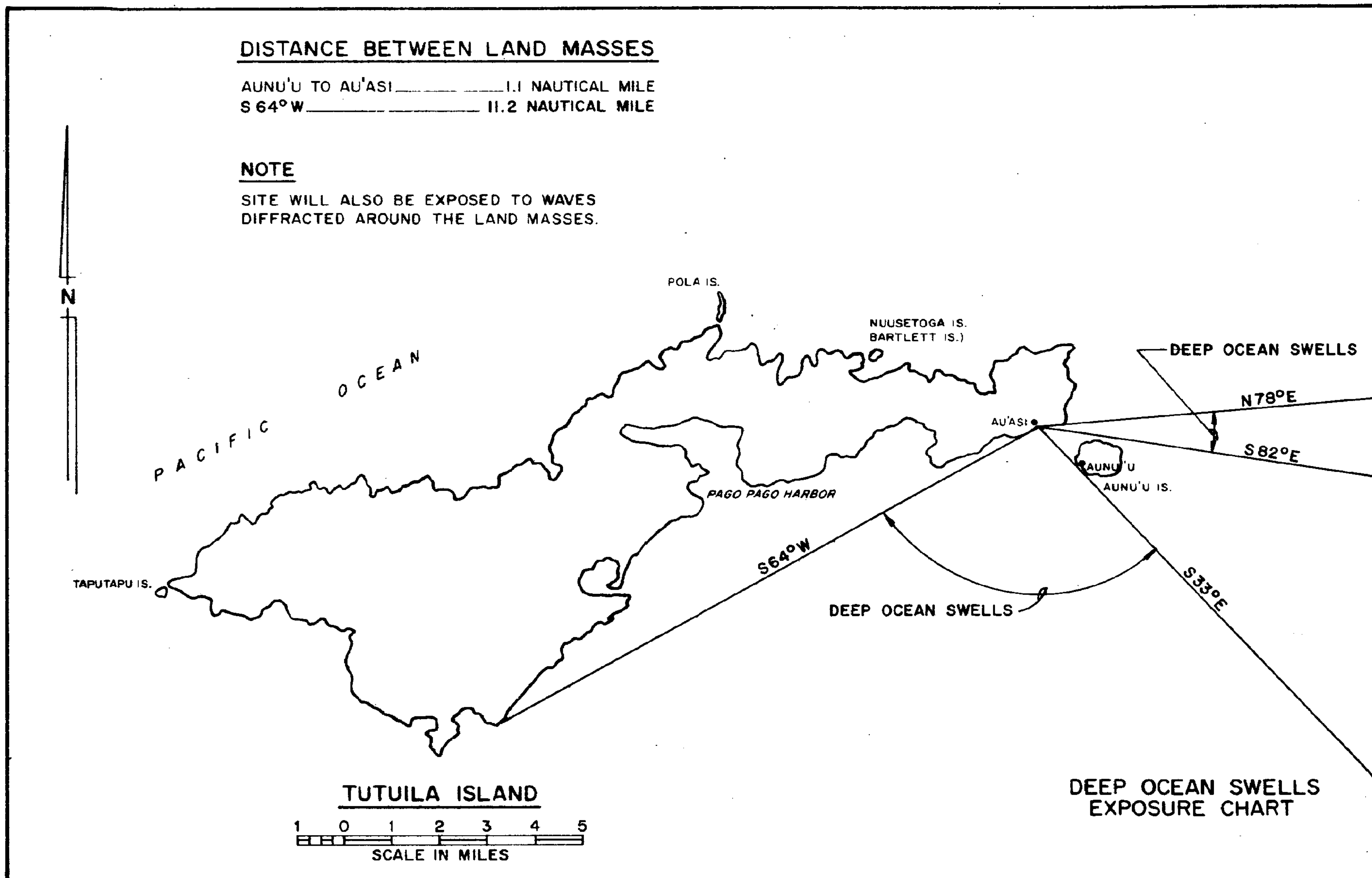


FIGURE B-3

FIGURE B-3

Table B-1. ANNUAL SEA AND SWELL CONDITIONS

Source: HO No. 799C-E "Atlas of Sea and Swell Charts, Northwestern Pacific Ocean and Southwestern Pacific Ocean

Seas - Total Number of Observations - 161 (Period 1932 - 1940)

Direction 1/	Percent of Total Observations	Condition Percent of Percent Observations for Direction		
		Light (1-2) 2/	Medium (3-4)	High (5+)
NW	3	100		
N	3	100		
NE	11	83	17	
E	31	64	32	4
SE	40	38	56	9
S	4		100	
Calm	2			
Other Directions	6			
Total	100	50	38	4

Swells - Total Number of Observations = 159 (Period: 1932 - 1940)

NW	2		100	
NE	8	69	17	14
E	30	62	32	6
SE	26	59	30	11
SW	8	36	55	9
Calm	10			
Other Direcxions	16			
Total	100	42	25	7

1/ Direction from which seas/swells are approaching.

2/ Wind force on Beaufort Scale equivalent to the following probable wave heights:

1-2	0.25 feet to 0.5 feet
3-4	2 feet to 4 feet
5+	6 feet+

and 1936. The hurricane season is between the months of November and April. The worst hurricane to strike American Samoa in modern times was that which passed through the islands on the 29th and 30th of January 1966. Wind gusts over 110 miles per hour were felt in Pago Pago and rainfall ranged from 6 to 14 inches. Losses to private and Federal property were estimated at $4.3 million, and five deaths were reported. Severe tropical storms affecting American Samoa occurred in 1968, 1969, and 1970. During a storm in 1968, Pago Pago reported a peak gust of 81 miles per hour, and total damage was estimated at $240,000. In 1969 and 1970, peak gusts of 72 and 53 miles per hour, respectively, were reported at Pago Pago. Damage was reported to be negligible.

10. On 1 January 1973, tropical cyclone Elenore damaged a seawall and a boat ramp at Fagasa on Tutuila and washed out about 800 feet of roadway. Pago Pago Airport reported a peak gust of 93 MPH with frequent gusts to 70 MPH. Sea level pressures dropped to 29.26 inches. About half of Tutuila's crops were damaged and some 60 percent of the banana trees, and many papaya and breadfruit trees were blown down. Repair of government facilities alone cost an estimated $200,000. On Ta'u Island, high waves swept over the seawall at Faleasao and damaged the powerhouse area. Many crops in the vicinity were either washed out or blown down. Although Aunu'u Island was also affected by tropical cyclone Elenore, no reports of the resulting damages are available.

11. The most recent storms to occur in Samoa were tropical cyclones Kim and Laurie. Kim passed within a few miles south of Tutuila on 10 December 1976. At Pago Pago Airport peak wind gusts from the northwest of 59 miles per hour and a low atmospheric pressure of 29.30 inches were recorded. At Cape Matatula, located at the eastern end of Tutuila near Auasi, a low pressure of 29.043 inches was measured. Tropical cyclone Laurie formed on the evening of 9 December in about the same area as Kim and followed a similar path towards the Samoa Islands passing a few miles just north of Tutuila Island on 11 December. At Cape Matatula on 11 December, a wind speed gust of 105 miles per hour was measured at which time the 60-foot-high steel weather tower was destroyed and the record ended. The lowest pressure recorded during Laurie was 28.729 inches. Both tropical cyclones continued moving east-southeast. As a result of both storms, the GAS estimated $585,000 in crop damages which included 75 percent of the banana crops totaling $400,000 and 50 percent of the breadfruit crop totaling $15,000.

12. Although the islands have experienced tsunamis, only Pago Pago has recorded any sizable runup. The tsunami generated by the Chilean earthquake in 1960 was most pronounced at the heads of Fagaloa Bay and Pago Pago Harbor where the maximum range was 15 to 16 feet. No reports of tsunami activity affecting Auasi could be found.

NATURAL RESOURCES

CLIMATE

13. The climate is tropical with yearly mean temperatures ranging from 70 to 90° F and humidity ranging from 80 to 85 percent. The prevailing southwest tradewinds blow from May to November with an average velocity of about 8 knots. The winds are variable the remaining months. The highest rainfall occurs during the summer (December to March). Rainfall on Tutuila averages 125 inches per year at the airport and 200 inches per year at Pago Pago Harbor.

14. Little data are available to describe the small regimes. Local residents record only rainfall at simple rain-gaging stations in several villages on Tutuila and report this information to the airport weather station. Although localized weather conditions may vary widely on the island at any given time, the long-term climatic pattern at Auasi village differs little from that observed at other coastal areas in American Samoa.

GEOLOGY

15. Tutuila Island is the top of a composite volcano rising some three miles from the ocean floor. Interpretive studies indicate it is formed of five volcanos located over two to three parallel rifts trending 20°E. Although young geologically, the island does not appear to be volcanically active at present.

16. The predominant rock types are basaltic, with lesser amounts of trachyte and andesite. The bulk of the volcanic rocks appear to be Pliocene or early Pleistocene in age. Recent appearing basaltic tuffs and lavas have formed a broad, flat plain in the southwest side of the island from Tafuna to Leone. Recent sediments consist of talus, alluvium, calcareous sand, coralline gravel, and reef rock.

17. GAS has developed a quarry at Fagaalu, near Pago Pago Harbor, and has obtained rights of way for a new quarry at Tula on the east end of Tutuila to supply construction materials.

TERRESTRIAL ENVIRONMENTAL SETTING

18. The vegetation of American Samoa consists of various botanical communities. Dense forest covers approximately 70% of the island of Tutuila with coverage as high as 90% on the Manu'a Islands. The higher percentage of land area not covered by tropical forest on Tutuila is a direct reflection of the impact of human-related activities. Tutuila is the population and economic center of all American Samoa. As a result, a higher incidence of land clearing activities related to agriculture, housing, and economic development are found on the island.

Taro and bananas are American Samoa's most important cash crops. They are grown in small plots for a maximum of two seasons, after which the plots are allowed to revert back to forest in order to regenerate lost soil nutrients. Small commercial plantations also grow breadfruit, sugarcane, and coconuts.

19. Few native animals inhabit the Samoan Islands due to the island's relative isolation and problems related to dispersal and colonization. Fowl, pigs, and dogs were introduced by the early Polynesians. There are no snakes, but lizards, millipedes, and centipedes are common. The Bufo frog, imported from South America to control mosquitos and centipedes, is abundant on Tutuila. Inspects associated with the warm tropical climate are problems on all the islands.

Birds are the most abundant form of wildlife though limited in numbers of species. None of the islands have more than 30 species of native birds. The White Collared Kingfisher (Halcyon chloris manuae), the Polynesian Starline (Aplonis tabuensis manuae), and the Fiji Shrike-bill (Clytorhychus vitiensis powelli) are included on a preliminary list of endangered birds in American Samoa.

Freshwater animals are uncommon since most of the stream flow only intermittently. It is unlikely that freshwater streams are inhabited by any endangered species.

20. The vegetation in the Auasi area, between the existing road and the shoreline, consists of coconut trees, Futu (Barringtonia), Milo, Ipomoea (beach morning glory), banana, and portions landscaped with grass and ornamental plants. Two recreational fales and a few homes are located on the shoreline. Seawalls protect about 50 percent of the shoreline from erosion. The shoreline area at Auasi does not appear to support a particularly unusual fauna.

MARINE ENVIRONMENTAL SETTING

21. Fringing reefs protect much of the shoreline of Tutuila from wave erosion. Freshwater stream discharge often cut "avas" (ravines) through reef flats where rip currents flow seaward. Shoreline areas are devoid of living coral reefs where substantial amounts of freshwater flows into the sea. These areas are characterized by heavy wave action, low salinity seawater, and rocky shores. Numerous species of reef fish inhabit waters surrounding the islands. In addition to fish, numerous invertebrates, including octopi, urchins, and of course corals, may be found on the fringing reefs.

Beyond the reefs, skipjack and yellowfin tuna are being commercially exploited, with fish canneries being located in Pago Pago Harbor. Marlin, sailfish, and dolphin attract sport fishermen.

22. The Auasi area, between Taugamalama Point on the southwest and Maatulaumea Point on the northeast, is fronted by a rather wide reef flat. The reef has a maximum breadth of 600 to 700 feet (180 to 215 m) centrally and is somewhat narrower near the southwest side of the main channel or "awa" which bisects the reef about 500 (150 m) southwest of Maatulaumea Point. Thus, the reef flat at Auasi can generally be described as consisting of a large southwest sector and a much smaller northeast sector. The main channel is the major outlet for the discharge of reef flat water and currents flowing seaward are often quite strong. The main channel strongly influences the longshore current over the reef, particularly in the southwest sector. The high elevation of most of the reef flat (0 to -1 feet) results in a complete exchange of water each tidal cycle and considerable solar heating during the day.

The shoreline in the Auasi area generally consists of sandy material of reef origin, much better developed in the south-southwest sector. In the northeast sector and near the headlands on each side of the shallow bay, are numerous basalt boulders. Beachrock occurs as isolated outcrops in the northeast and mid-southwest sectors.

23. Based on a marine survey of the project area by the Bernice P. Bishop Museum of Honolulu, Hawaii, the reef fronting the Auasi area can be organized into several zones. The reef platform, from the shoreline to the reef margin, exhibits a highly variable distribution of live coral cover. However, the averages for all sampling locations indicate fair cover generally decreasing (9 to 4%) over a distance of 0 to 300 feet (0 to 90 m) from shore, after which coral cover gradually increases to 22% at the reef margin (600 feet, or 180 m, from shore). Coral growth is well developed on the seaward reef slope (600 feet from shore) with live coral accounting for 60 to 79% of the bottom.

The fish population at Auasi is quite diverse and reflects a broad spectrum of species expected on the basis of previous surveys in American Samoa. The abundance and diversity of fish increases with increasing distance from shore, with adult fish becoming more dominant than juveniles. The majority of reef platform fish are highly dependent on the benthic substratum for concealment, with only a minority of the forms wide ranging. Offshore, on the reef slope, the number of free swimming species increases while benthic-associated forms decrease.

24. Subsistence fishing occurs frequently on the reef, especially on the marginal portion. Local residents spear fish along the reef front, and night spearing is done using a hand held torch.

HUMAN RESOURCES

POPULATION CHARACTERISTICS

25. The US Census data listed below shows that 27,159 people lived in American Samoa in 1970. Preliminary data from the Samoa Development Planning Office indicates that the population increased to 29,171 in 1974. 1/

US CENSUS

Table B-2. POPULATION OF AMERICAN SAMOA

Year	Population
1940	12,908
1950	18,937
1960	20,051
1970	27,159

The above data shows that between 1940 and 1950, the population grew 46 percent, but between 1950 and 1960, it grew only 6 percent. Apparently, the 1950's period was one of very heavy out-migration. A reversal in the population decline was indicated between 1960 and 1970, during which time the population grew 35 percent giving an annual growth rate of 3.1 percent. However, during this same period, the rate of natural increase was estimated to be 3.8 percent. Therefore, a net out-migration trend was still occurring although not as dramatically as that which occurred during the 1950's. A 1968 economic development study of American Samoa suggested that, after weighing migration, employment and natural increase factors, a growth rate averaging approximately 1.64 percent would prevail during the 1970 decade. This indicates that the population of American Samoa would reach 32,000 by 1980. If the rate of growth slows still further during the 1990 decade and thereafter, it is reasonable to expect that the growth rate will be similar to the Series C projection used by the Office of Business Economics (US Department of Commerce) for the United States. This rate is approximately 1.45 percent growth per year for the period 1970 to 2020. Such a rate for American Samoa between 1980 and 2025 would increase the population to 58,000 by 2025, as shown in the following table:

1/ American Samoa 1974 Annual Report to the Secretary of the Interior prepared by the Office of Samoan Information.

Table B-3. POPULATION PROJECTION FOR AMERICAN SAMOA

Year	Population Projection
1980	32,000
1990	36,600
2000	41,800
2010	47,700
2020	54,500
2025	58,000

26. The people most affected by the project are those living on Aunu'u Island. The 1970 Census shows that 1.5 percent of the total population or 425 people live on Aunu'u. The Island of Aunu'u is within Sa'ole County, a portion of which is located on the main island of Tutuila. Tutuila is divided into two districts, the Eastern District with six counties and the Western District with four counties (Figure B-4). Sa'ole County is in the Eastern District. Table B-4 shows the population of the six counties within the Eastern District for the years 1960 and 1970 and the percent change.

Table B-4. POPULATION CHANGE, 1960 - 1970

County	Population 1960	Population 1970	Percent Change
East Vaifanua	972	1,163	19.7
Itu'au	1,887	2,884	52.8
Hauputasi	5,340	7,886	47.7
Sa'ole	1,105	1,295	17.2
Sua	1,500	2,336	55.7
West Vaifanua	333	391	17.4
Total Eastern District	11,137	15,955	43.3

The 1970 population of the six villages in Sa'ole County was Alofau, 378; Amouli, 356; Au'asi, 74; Aunu'u, 425; Fogaau, 31; and Utumea, 30.

27. Although the census shows an overall increase in the population of the territory and Sa'ole County between 1960 and 1970, a breakdown of the data for Sa'ole County shows an approximately 2.5 percent decline in the population of Aunu'u Village from 436 in 1960 to 425 in 1970. It is noted that all of the villages in Sa'ole County that are located on Tutuila registered an increase in population, while Aunu'u which is isolated from the main island showed a decline. The population decline, which also occurred in outlying villages without connecting roads on Tutuila, is attributed to inadequate overland and interisland transportation. The result has been a gradual shift in population from the isolated

outlying villages to the urban areas of Tutuila, particularly around Pago Pago Bay. This shift is of concern to government officials because it is contributing to intense urban congestion. The population on Tutuila increased 46 percent from 16,814 in 1960 to 24,548 in 1970.

28. With improved interisland transportation, the population of Aunu'u can be expected to decline at a slower rate until about 1980, followed by a population increase similar to that expected for the rest of American Samoa. Without a harbor, the rate of decline experienced since 1960 can be expected to continue as shown in Table 5.

Table B-5. ALTERNATIVE POPULATION PROJECTIONS FOR AUNU'U

Year	Without Harbor	With Harbor
1960	436	-
1970	425	-
1975	420	420
1980	415	415
1985	410	440
1990	405	470
2000	395	540
2010	385	620
2020	375	700
2025	370	750

CULTURAL/HISTORICAL RESOURCES

29. The amount of land available for habitation on coastal flats, such as Auasi, is restricted by the coastal-interior extent of the plain, which usually terminates abruptly in high, precipitous cliffs. Thus, land use is heavily influenced by physiography, and may be characterized by extensive exploitation of what little area and resources are available. Interrelated with land use is the established practice of reutilizing stones and coral from abandoned house platforms. As a result, the preservation of older structural remains in American Samoa has been, in many cases, almost nonexistent.

30. A reconnaissance survey of the project area by the Bishop Museum, Department of Anthropology, revealed no remains of archaeological or historic sites. The landward limit of the survey area coincides with the passage of the modern road (approximately 100 to 150 feet from the shoreline), which by virtue of its construction, would have obliterated any traces of surficial archaeological or historic remains.

MAJOR SKILLS AND OCCUPATIONS

31. Employment trends in American Samoa reflect the shift from a subsistence type of economy to a cash economy. Many Samoans now prefer the cash-paying jobs available in the urban areas, and particularly with the

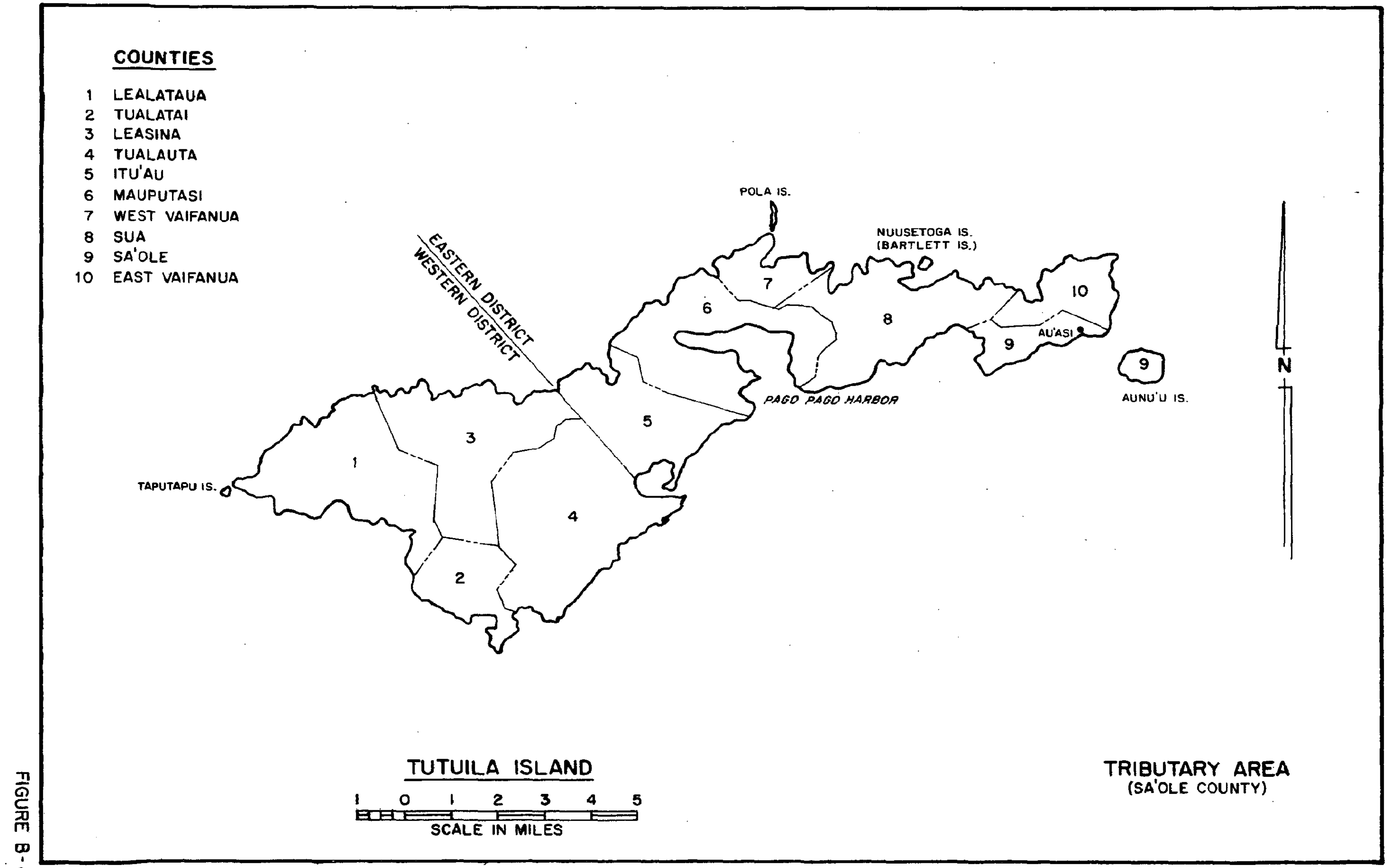

COUNTIES
1 LEALATAUA
2 TUALATAI
3 LEASINA
4 TUALAUTA
5 ITU'AU
6 MAUPUTASI
7 WEST VAIFANUA
8 SUA
9 SA'OLE
10 EAST VAIFANUA
EASTERN DISTRICT
WESTERN DISTRICT
POLA IS.
NUUSETOGA IS.
(BARTLETT IS.)
AU'ASI
AUNU'U IS.
PAGO PAGO HARBOR
TAPUTAPU IS.
N
TUTUILA ISLAND
1 0 1 2 3 4 5
SCALE IN MILES
TRIBUTARY AREA
(SA'OLE COUNTY)
FIGURE B-4

FIGURE B-4

Government of American Samoa (GAS), the largest single employer on the island. In 1974, the GAS employed 3,714 islanders. Other leading employers, located in the Pago Pago Harbor area, were the food processing industry, including can manufacturing, and the shipping and transportation industry which includes seafaring and dockside personnel.

Industries in the new industrial park near Nuuuli include a jewelry manufacturer and exporter, a watch assembly plant, and an industrial gas plant.

SOCIAL STRUCTURE

32. The keystone of the fa'a Samoa (the Samoan way of life) is the communal social structure which consists of the extended family (aiga), the primary social unit, with a chief (matai) directing the family's affairs. All members of the family owe their loyalty and service to the aiga, through the matai who manages the family lands and finances and appoints lesser matais to serve him and carry out certain responsibilities. In the society at large, there is a complicated system of titled chiefs, high chiefs, paramount chiefs, and talking chiefs who distribute power and influence as well as property.

33. In recent times, for better or worse, the traditional Samoan social structure and value system have been undergoing rapid change and "modernization". United States possession has had a profound effect on the lives of the Samoan population, the major influences being American education, conversion from a subsistence to a cash economy, desires for imported goods, and exposure to non-Samoan values and customs through mass media, tourists, and relatives returning from the United States. The effects of Western influence on the Samoan lifestyle are most evident around Pago Pago Harbor. Many people in the project area and its tributaries commute to work and recreation in the Pago Pago area, thus daily transcending the old family/village bounds.

EDUCATION SYSTEM

34. The larger villages and those that are relatively isolated along the shoreline have established schools for the elementary grades. High school students commute (by foot or by bus) to three facilities on Tutuila, including the largest at Pago Pago. A community college with an enrollment of about 1,000 is located at Mapusaga on the Tafuna-Leone plain. Student commute to the college from all over the island by foot, bus or private auto.

35. Although much of the current labor force is engaged in unskilled work, an increasing number of Samoans are seeking higher education in professional fields and are expected to gradually assume jobs now held by non-Samoans (palagi). This is in consonance with the US Department of Interior's goal to promote economic, social, and political development leading to a full measure of self-Government and the active participation of the residents of American Samoa in the life of their territory.

DEVELOPMENT AND ECONOMY

URBANIZATION

36. The Pago Pago Bay area of Tutuila is the urban center of American Samoa. Unlike the outlying villages, housing in the bay area follows the Western tradition, including plumbing and electricity. Although low income precludes the purchase of new housing by most Samoan families, the demand for housing that combines Western and traditional features has been growing.

37. Outside of Pago Pago most residential development is in small, low-density villages located on the valley floor deltas where the steep headlands meet the sea. The villages remain essentially native and consist of small frame houses and grass or tin roofed "fales". However, in many lowlying villages, concrete blockhouse construction is being employed as it is more resistant to hurricane damage. In recent years, as the people have begun to use the roads more and more to commute to their jobs, school, and to travel between villages, the traditional clustered village arrangement has changed in some areas and villages have formed in linear patterns along the roads.

38. The isolated outlying villages such as that on Aunu'u remain essentially native and consist of "fales", the traditional Samoan dwelling. These structures are usually oval and are of poles supporting a thatched roof over a foundation traditionally built of loose stones or coral raised to a height of 1 or 2 feet above the ground. Aunu'u Village consists of about 75 homes varying from the traditional "fales" to Western style wood-frame structures. Communication is primarily by word of mouth except for radio communication between Government of American Samoa agencies. Electrical power is obtained from Tutuila through an underwater cable. There are no roads or harbors on the island. Walking is the only means of overland transportation. Interisland transportation is accomplished over water since there is no air service to the island.

39. The attraction of cash-paying jobs and of the modern conveniences of the Pago Pago Bay area has caused an increasing number of Samoans to leave their native villages. This, however, is contributing to urban congestion on Tutuila and its attendant environmental problems. Therefore, means of controlling urban population density are being investigated, including the construction of roads to isolated villages and the construction of small boat harbors to villages which are accessible only by boat and secondary transportation through the reef by longboats. Because of the Samoan people's love for their native villages, it is felt that with improved transportation, many peoole will remain in their villages and many who have moved away will return.

LAND TENURE

40. The traditional system of land tenure in American Samoa is based on communal lands claimed by extended families (aigas). Traditionally, the basic claim of each aiga is recognized by every other; the land essentially remains within each aiga's control and is therefore rarely transferred for any purpose. Land alienation laws aimed at preserving this Samoan custom have been in existence since the first US Navy administration in 1900. These laws prohibit any extended family chief (matai) who controls the family's lands to alienate such lands or any part of it to any person without the written approval of the Governor of American Samoa. They also prohibit alienation of any land except frehold lands (those included in court grants prior to 1900) to any person with less than 50 percent native blood. The laws dealing with leasing and public use limit the term of private leaseholders to 30 years and require the written permission of the Governor. These laws, however, do not prohibit the conveyance of native lands to the government for public use, or upon written approval of the Governor, do not prohibit conveyance of land to religious societies.

41. The laws have been effective in protecting Samoan ownership of their land to the extent that at present 92 percent of all land is communally owned, a fraction of 1 percent is on a freehold status, but may be sold to those with 50 percent or more Samoan blood, and the remaining 7 percent or so is held about equally between the Government of American Samoa and the churches. Thus, approximately 96 percent of all land in American Samoa belongs to the people and will continue to belong to them because of their attitude and high regard for land ownership. Consequently, it will remain difficult for non-Samoans to obtain use of land, particularly those held by the extended families.

42. Existing land-use patterns at Auasi and Aunu'u conserve land resources. The villages are organized to promote social interaction and multi-use of the village's land area. Although detailed land-use plans have not yet been formulated, the Preliminary General Plan for American Samoa prepared in 1973 indicates that future plans will be designed around existing activities and land-use patterns.

43. No coastal zone management program has been developed for American Samoa. The filling of reef flats to create more land for urban and industrial development has occurred on Tutuila. In some cases, the reclaimed submerged lands appear to serve as shore protection for villages situated close to the water's edge. In other cases, reclaimed lands encourage construction of public or private homes and facilities near the water's edge, exposing them to storm wave attack and erosion. The highway along much of the south shore of Tutuila, for example, was built close to the shoreline despite the fact that the area is exposed to hurricane and storm wave attack. In general, the wetland reclamation practices resulted from the lack of moderately sloped upland areas. The difficulty in obtaining land-use rights from local landowners has also encouraged the practice.

COMMERCE

44. Imports during Fiscal Year 1974 totaled $46,539,656 a 29 percent increase over imports of $35,952,859 for Fiscal Year 1973. Revenue from exports for FY 1974 totaled $82,988,726, a 24 percent increase over the $66,576,005 for FY 1973. Canned tuna accounted for 89 percent of the 1974 exports. Fish products other than tuna accounted for 5 percent, while handicraft, watches, and all other curios accounted for the remainder of the shipments from American Samoa.

INDUSTRIES

45. Commercial Fishing. The tuna cannery complex is the mainstay of the private economy of American Samoa. In FY 1974, the fishing industry accounted for $77,724,773 of the territory's $82,988,726 value of exports. Two fish canneries and a supporting can manufacturing company are located on the north shore of Pago Pago Harbor. The tuna canneries are the largest private employers on the island, however, over one-half of the employees hired by the fishing and canning industry are non-Samoans. Presently, the canneries employ about 1,200 Samoans but are entirely dependent on foreign flag vessels and crews for their fish. Approximately 255 fishing vessels, including Korean, Taiwanese, and Japanese ships, were based in American Samoa in 1973.

46. The commercial fishing industry was originally established to employ fishermen from among the inhabitants of American Samoa; past experience showed that the Samoans had little inclination to become high seas fishermen. Recently, however, an increasing number of local inhabitants have begun sport and commercial fishing.

The local small craft fishing fleet increased to 23 boats as five new 24-foot "Samoan dories" were added to the existing fleet in 1974. The Office of Marine Resources collected catch and effort data from 11 dories which reported fish sales of 120,419 pounds in 1974, worth more than $71,000. It is estimated that the entire dory fleet had a total catch of over 200,000 pounds. This operation involves over 100 fishermen selling commercially through village stores on Tutuila. A harbor at Auasi would permit boats fishing off the east end of Tutuila to unload their catch daily for distribution to the markets, thus saving a costly and time-consuming boat trip to Pago Pago Harbor.

47. Surveys made by the Office of Marine Resources to determine the availability of bottom fish have indicated that a substantial unutilized bottom fish resource exists in American Samoa. Furthermore, a study of the fishing resources indicates that American Samoa could support a substantial fleet of bottom fishing boats to supply domestic demands. A Samoan fleet to catch tuna for sale to the two canneries could also be supported because the canneries can take all of the fish available to them.

48. Although the commercial fishing industry is presently the most important private economic force in American Samoa, it is not expected to be one of the major growth industries of the islands. Rather, this industry is expected to remain a relatively stable element of the American Samoa economy with modest growth attributed to availability of adequate harbors.

49. Tourism. Tourism is the second largest industry in American Samoa and is considered the major potential growth industry. There were 53,376 visitors during fiscal year 1974, an increase of 8 percent over fiscal year 1973. 23,254 cruise ship passengers visited American Samoa during fiscal year 1974, an increase of 23 percent over the previous year. Based on past experience, it is estimated that if visitor facilities and activities are made available to meet potential demand, the number of tourists will increase to more than 300,000 by 2025. Table B-6 shows the number of visitors to American Samoa for the period 1966 to 1975.

Table B-6. VISITORS TO AMERICAN SAMOA

(VISITING 24 HOURS OR LONGER)

Year	Number of Tourists	Year	Number of Tourists
1966	4,401	1971	19,199
1967	9,617	1972	24,849
1968	11,786	1973	27,937
1969	13,940	1974	30,122
1970	15,000	1975	(36,000) Est.

Based on the above data, if visitor facilities and activities are made available to meet potential demand, it is estimated that the number of tourists will increase to nearly 50,000 by 1980.

50. Three major airlines serve American Samoa on flights between Hawaii and New Zealand. In addition, there are daily flights between the island of Tutuila and Apia in Western Samoa. Many visitors also come by cruise ships which call at Pago Pago throughout the year. Bus tours to other parts of Tutuila are available for the visitors enjoyment. The people of Aunu'u want a connecting route by sea from Auasi to their island to facilitate the development of a tourist trade there.

51. The tourism office continues to direct and coordinate the territory's efforts in the field of visitor interest. The tourism office has been emphasizing the development of tourist-related facilities and activities within Samoa, such as highway and village beautification projects, rather than tourist-promotion of American Samoa abroad.

52. Presently, a shortage of hotel rooms continues to be the deciding factor on the number of visitors who can stay for longer than one day. There are only three hotels in American Samoa with a total of 216 rooms. All of the hotels are located in the island of Tutuila. There are no hotels or tourist facilities on Aunu'u.

53. Agriculture. Presently, only a few small-scale commercial farmers are active in American Samoa. Most of the present agricultural production throughout the territory is at the subsistence or family level. However, rising population and the attractiveness of cash paying jobs in the canneries, government, and the construction and tourist industries have caused many American Samoans, particularly on Tutuila, to deemphasize farming and to turn to imports for satisfaction of their food needs. This is not the case in Aunu'u, where most families still actively engage in subsistence farming. There is a definite market for locally grown taro, the staple of the local diet, particularly since most of the taro is presently imported from Western Samoa. In addition, there is a growing local market for vegetables to satisfy the needs of Oriental fishermen, the increasing number of tourists, and the local Samoans whose eating habits are being influenced by the school lunch program and influx of outsiders.

54. Agriculture could become a more attractive enterprise if better transportation facilities are provided to facilitate marketing of produce. At least 10 percent of the taro consumed by islanders could be produced on Aunu'u if adequate transportation to Tutuila markets was available. According to discussions with Department of Agriculture personnel, there is a definite need and hope that Aunu'u will be able to supply more of the agricultural products for the territory's consumption. Agricultural officials do stress, however, that before any agricultural advancements can be achieved, the existing water transportation system for Aunu'u must be improved.

55. Manufacturing. Light manufacturing such as jewelry making, a watch assembly plant, and an industrial gas plant account for about 6 percent of the value of exports from American Samoa.

56. Construction. At present, the GAS is the major construction company in the Territory with a work force of over 3600 employees. Between 1973 and 1976, the Department of Public Works completed work on 95 projects in the Manu'a Islands and on Tutuila. These projects include primary and secondary roads, village trails, extension of the water supply system, sewer system improvement, improved stream crossings, playgrounds, seawalls, small boat harbors, and installation of signs and guardrails on Tutuila's highways. In addition, the GAS operates a concrete batch plant and two quarries and has heavy equipment, including a crane with a 25-ton lift and a 1 1/2-yard dragline. Currently, nine private firms are engaged in construction activities in American Samoa.

SECTION C

PROBLEMS, NEEDS, AND OBJECTIVES

SECTION C

PROBLEMS, NEEDS, AND OBJECTIVES

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SECTION C

PROBLEMS, NEEDS, AND OBJECTIVES

THE NAVIGATION PROBLEM

1. American Samoa is served by sea and air transportation. Pago Pago Harbor is one of the best deep-draft harbors in the South Pacific, and all waterborne commerce entering or leaving American Samoa passes through it. Pago Pago International Airport is the only airport in American Samoa which handles international air traffic, as well as interisland air traffic between the Manu'a Islands and Tutuila.

2. Interisland transportation is primarily by sea. The new harbor constructed in 1975 at Ofu Island, and the harbor presently under construction at Ta'u Island greatly improve the efficiency safety of water transportation to the Manu'a Islands. Landing strips to accommodate light aircraft were constructed on both Ta'u and Ofu islands in 1973 and 1974, respectively. Cargo is generally limited to items carried on board by the passengers.

3. Bacause of the small size of Aunu'u Island and its proximity to Tutuila, there is no air transportation system servicing the island. The only way for residents and cargo to get to and from the island is by the existing interisland water transportation system. Bulk cargo is transported to Aunu'u by tug and barge on an as-required basis. A new small boat harbor at Aunu'u was authorized in 1976 to eliminate the existing difficulty and hazard resulting from the need to lighten all the cargo from the tug or barge to shore using longboats and outboard motorboats.

4. Daily travel by workers, students, and shoppers cannot be made from Aunu'u to Pago Pago Harbor because of the lack of adequate vessels, distance (8 nautical miles), cost, and often adverse sea conditions. Daily travel from Aunu'u Island is made by longboat and outboard motorboat to the village of Auasi on the island of Tutuila, a distance of 1.2 miles. Auasi is located in the lee of Aunu'u Island with respect to the prevailing winds and waves, and the channel is generally navigable by small boat.

5. The longboats are about 30 feet long, 4 feet wide, and have a draft of about 18 inches. They are manned by a minimum of 6 oarsmen and 1 helmsman, but require as many as 20 oarsmen during periods of rough seas. With a minimum crew of seven, the longboats can carry 40 children or 20 adults or about 2.5 tons of cargo. Depending on sea conditions, the longboats require from 30 to 45 minutes to cross the channel between Aunu'u and Auasi. To reach the shore at Auasi the boats must navigate a narrow natural channel through the surf at the reef edge and then are pulled across the reef and up on the beach to prevent damage to the boats.

6. The present "commuter" population now crosses the channel between Aunu'u and Auasi daily in about five longboats and several outboard motorboats. During inclement weather, especially on windy days, the trip is very hazardous. Navigating through the surf at Auasi is particularly dangerous, especially for the very young, the elderly, and the infirm. Over the years, longboats have overturned many times, occasionally resulting in death by drowning. Between Aunu'u and Auasi, 20 drownings occurred over a 10-year period. Because of the lack of a protected mooring at Auasi during periods of high wind and seas and the boats cannot remain at Auasi and must return to the relative safety of Aunu'u, thus doubling the daily trips between the islands.

7. During discussions with village chiefs and representatives from Aunu'u and Auasi, they expressed a desire to develop a visitor destination point on Aunu'u Island if a harbor could be developed at Auasi to provide a safe landing for transportation between the islands. In addition, because of the numbers of people commuting daily to Tutuila, a larger powered "ferry" boat could be effectively utilized to replace the present rowed longboat if adequate navigation facilities were available.

8. Small commercial fishing boats, 20 to 40 feet long, could use a protected mooring when fishing the east end of Tutuila. This would permit offloading of the day's catch at Auasi to be trucked to the markets at Pago Pago, and reduce travel cost and time presently required for the boats to return to Pago Pago Harbor each night with their catch. However, presently available information on fishing activity is inadequate for quantifying possible future fishing benefits.

9. Small sailboats and power boats would utilize a safe mooring at Auasi for overnight trips to the east end of Tutuila.

10. An all weather harbor is not required. During periods of severe storm wave attack Aunu'u residents would not leave the island, and the authorized Aunu'u Small Boat Harbor when constructed would provide storm protection for small boats.

RELATED PROBLEMS AND NEEDS

ENVIRONMENTAL RESOURCES

11. The Government of American Samoa recognizes the need to maintain the territory's natural environmental quality which plays a significant role in the traditional Samoan lifestyle. Therefore, although they are trying to upgrade the territory's infrastructure, and are working to achieve this goal, they are also making every effort to implement only those changes which would improve the Samoan living standards without resulting in significant adverse impacts on the environment.

12. The nearshore reef areas off Auasi village are valued for their marine resources which are sources of food for the residents who still maintain a subsistence level of economy. In addition, the reefs are also an integral part of the natural scenic beauty of the islands. Although some environmental damage has occurred from past development, especially within the confines of Pago Pago, the outlying areas of the island of Tutuila, such as Auasi, still retain much of its natural beauty, particularly when compared with urbanized areas of the United States.

HUMAN RESOURCES

13. The sea is the only means by which the residents of Aunu'u can reach the commercial activities and public facilities and services on the island of Tutuila. Workers commuting to their jobs, school children, and others utilizing the public services in Pago Pago, including the territory's only medical facility, all depend on the sea link between Aunu'u and Auasi. Navigation improvements are necessary in order to promote social and economic development of Aunu'u Island and reduce the hazards to life presented by the present navigation system.

DESIRED IMPROVEMENTS

14. The Governor of American Samoa by letter dated 24 October 1969, requested a study of harbors in American Samoa to determine the feasibility of providing improvements for navigation and related purposes. A reconnaissance report for harbors at Auasi and Aunu'u was completed in January 1970.

15. By letter dated 16 October 1975, the GAS Director of Public Works requested that the detailed investigation of Auasi navigation needs be studied under the Section 107 authority. He stated that construction of small boat facilities at Auasi was required to eliminate the hazard for persons traveling daily between Aunu'u and Tutuila islands, and to make the transport of passengers and cargo reasonably safe under all but hurricane conditions.

16. During meetings with chiefs and village representatives from Auasi and Aunu'u held in December 1976 and April 1977, the need for improved and safe landing facilities at Auasi was strongly emphasized. The meeting participants stated that the present method of bringing the longboats and motorboats to shore was extremely hazardous during moderate sea conditions and almost impossible during high (5-foot plus) wave conditions. The chiefs stated that the existing conditions have resulted in loss of income due to an inability to get to work or get produce to the markets, as well as considerable loss of goods and lives resulting from swamping and overturning of the longboats. The village chiefs expressed a desire for a facility to accommodate their longboats, motorboats, and fishing boats, as well as a future capability for larger vessels that may travel between Auasi and Aunu'u as a passenger ferry service.

17. During discussions with GAS personnel and the Director of Port Administration, they indicated the need to accommodate the existing craft, as well as a 40-foot utility vessel with a 4-foot draft. They also stated that Auasi is well served by road, and no shipment of goods by tug or barge would be made from Pago Pago Harbor to Auasi, and bulk cargo bound for Aunu'u would be shipped directly from Pago Pago Harbor to the new small boat harbor authorized for Aunu'u. Thus, no need exists to accommodate a large interisland vessel such as was used as the design vessel for the Ofu, Ta'u, and Aunu'u small boat harbors.

PLANNING OBJECTIVES

18. The planning objectives for the Auasi Small Boat Harbor were developed based on an analysis of the social, economic, and environmental aspects of the project area, and the identification of problems and needs attending navigation as well as environmental and human resources. The following planning objectives were adopted to guide the formulation and evaluation of alternative project plans:

a. Improve the existing interisland transportation between Aunu'u Island and the village of Auasi on the island of Tutuila by providing a safe and efficient landing for persons commuting daily between the two islands, excluding periods of severe storms or hurricanes.

b. Minimize destruction of or adverse impacts to the nearshore marine environment.

c. The improvements recommended for implementation should be engineeringly effective, economically justified, and environmentally and socially acceptable.

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FORMULATING A PLAN

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SECTION D

FORMULATING A PLAN

FORMULATION AND EVALUATION CONCEPTS

1. The formulation and analysis of alternative solutions to achieve the planning objectives were based on the Water Resources Council's Principles and Standards for Planning Water and Related Land Resources (P&S). The evaluation and assessment of economic, social, and environmental effects also followed the guidelines of Section 122 of the River and Harbor Act of 1970 (Public Law 91-611) and the National Environmental Policy Act of 1969 (NEPA). The formulation of alternative plans of improvement was guided by the following technical, economic, and environmental criteria.

2. TECHNICAL CRITERIA

a. The improvements should provide safe navigation and protection during all weather and sea conditions with the exception of periods of severe tropical storms and hurricanes.

b. Protective works should be designed for overtopping by a design wave which may be expected from a severe combination of meteorological and hydrological conditions that are reasonably characteristic of the area.

c. The harbor should be designed to accommodate a vessel with a 40-foot length, a 12-foot beam, and a 4-foot draft.

d. The entrance channel should be of adequate depth and width to safely accommodate one-way traffic by the design craft. The protected harbor basin should provide adequate maneuvering area for the design vessels.

3. ECONOMIC CRITERIA

a. The plan should be economically sound, the benefit-to-cost ratio should be at least unity, and the net benefits, as far as practicable, should be maximized.

b. The cost for alternative plans of improvement are based on preliminary layouts and estimates of quantities, and August 1977 unit prices. The benefits and costs are expressed in comparable quantitative economic terms to the fullest extent possible. Annual costs are based on a 50-year amortization period and a 6.5/8 percent interest rate. The annual charges include the annual maintenance cost.

4. ENVIRONMENTAL CRITERIA

a. Minimize the physical destruction of resources on the fringing reef during harbor construction.

b. Minimize long-term disturbances to the physical environment (e.g., water circulation, water quality, and sediment transport) which may have secondary impacts on the living resources that inhabit the fringing reef.

c. Minimize disturbance to village life and use of village lands.

5. The following general concepts were also used to guide the formulation, assessment, and evaluation of alternative harbor plans:

a. Both adverse and beneficial impacts of alternative plans should be identified and measured, and the beneficial or adverse contributions of each plan evaluated;

b. Alternative plans which maximize net economic benefits (National Economic Development - NED plan) and those which are likely to make significant contributions to preserving, maintaining, restoring, or enhancing cultural and natural resources (Environmental Quality - EQ plan) should be designated;

c. The plans should be developed in order to minimize conflicts, maximize compatibility, and insure completeness;

d. The desires of local interests should be given full consideration; and

e. The plans should be evaluated with respect to their acceptability, certainty, completeness, effectiveness, efficiency, benefit-cost ratio, and reversibility.

IDENTIFICATION OF ALTERNATIVE PLANS

6. Possible navigation improvements in the Auasi area were investigated based on the evaluation of problems and needs and the expressed desire for improving sea transportation between Aunu'u Island and Auasi. A solution of no action was not considered because it would not meet the expressed desire for improvement, which is the basic objective of this study.

7. Although it would not provide an entirely all-weather link between Aunu'u and Auasi, improving the existing ocean transportation system through harbor construction would result in greatly improved daily

commuter travel, less loss of personal goods and light cargo, improved daily transportation for fresh produce from Aunu'u Island to the markets in Pago Pago, and greater safety for persons traveling daily between Aunu'u and Auasi.

ALTERNATIVE SITES

8. Alternate harbor sites on Tutuila Island at Fagaitua Bay and the village of Auasi were considered.

9. Fagaitua Bay is a large, deep bay approximately 4 nautical miles west of Aunu'u, and offers several areas with good natural protection. However, its distance from Aunu'u resulting in longer travel time and exposure to rough seas, and the lack of available vessels capable of making the trip on a daily basis, precludes its selection as a potential harbor site capable of satisfying the planning objective of providing a safe and efficient harbor for daily transportation from Aunu'u to Tutuila.

10. The village of Auasi, is fronted by a shallow bay and is the closest landfall on Tutuila for persons traveling from Aunu'u. Auasi is the traditional landing place for persons traveling between Aunu'u and Tutuila, and as such, the village has close ties with Aunu'u Island and is very receptive to having a harbor built on their shoreline which will primarily benefit the people of Aunu'u. Auasi is approximately 1.2 miles from Aunu'u, and is in the lee of the island which provides a measure of shelter for small boats traveling from Aunu'u. Based on the foregoing, the Auasi area was selected for detailed studies for navigation improvements.

ALTERNATIVE HARBOR PLANS

11. Various harbor configurations for the Auasi site were investigated to develop a plan which would best satisfy the established engineering, economic, and environmental criteria. Four harbor plans were developed in detail and are presented in the following paragraphs. Harbor Plans 1 through 3 are located in the center of the shallow bay, and Plan 4 utilizes the existing approach channel at the east side of the bay. The general engineering features of the alternative plans are summarized in Table D-7, and the plans are shown in Figures 4 through 7.

12. Plan 1. This plan consists of a 60-foot-wide, 490-foot-long, 10-foot-deep entrance channel, and a 100-foot by 100-foot, 8-foot-deep turning basin (Figure D-5). In an effort to minimize the impact on the reef no provision was made to moor vessels and no protection from wave action is provided. The plan provides safe navigation through the reef and a fair weather landing. The shoreline immediately landward of the basin would be protected by a 7,000 square foot revetted fill area. Docking facilities would be provided by local interests.

13. Plan 2. This plan provides for a 60-foot-wide, 430-foot-long, 10-foot-deep entrance channel, and a 36,000 square foot turning/mooring basin. The basin would be protected against wave action by a 250-foot-long breakwater with a crest elevation of +10 feet (Figure D-6). The basin would provide a safe landing and mooring during all but severe storm wave conditions. Approximately 430 linear feet of reactment would be constructed to contain spoil material and create 24,000 square feet of harbor backup space.

14. Plan 3. This plan is similar to Plan 2, except that the harbor is offshore to minimize impact to the shoreline and reduce the required dredging. The entrance channel and basin size are the same as for Plan 2, except that the channel is only 280-feet-long. The breakwater would be 280-feet-long and a 190-foot-long revetted mole with a crest elevation of +10-feet would be constructed at the west end of the harbor because of its proximity to the breaker zone and to provide for a landing area. A revetted causeway would be constructed to provide access to the harbor (Figure D-7).

15. Plan 4. Plan 4 is located at the east end of Auasi village in the vicinity of the existing natural channel and the shoreline currently used as a landing area. The plan provides for a 370-foot-long, 60-foot wide, 10-foot-deep entrance channel excavated landward from the existing natural channel, and a 35,000-square-foot, 8-foot-deep turning/mooring basin. A 110-foot-long revetted mole and 170-foot-long breakwater, with +10-foot crest elevations, provide wave protection for the basin and backup area. A 525-foot-long revetment would be constructed to contain spoil material and create 33,000-square-foot harbor backup area (Figure D-8).

TABLE D-7

ENGINEERING FEATURES OF ALTERNATE PLANS

Feature	Plan 1	Plan 2	Plan 3	Plan 4
Entrance Channel				
Length, feet	490	430	280	370
Width, feet	60	60	60	60
Depth, feet	10	10	10	10
Alignment	N35 W	N35 W	N35 W	N35 W
Turning/Mooring Basin				
Area, square feet	10,000	45,000	45,000	35,000
Depth, feet	8	8	8	8
Breakwater				
Length, feet	-	250	280	170
Crest, Elevation, ft	-	+10	+10	+10
Revetted Mole				
Length, feet	-	-	190	110
Crest Elevation, ft	-	-	+10	+10

ASSESSMENT AND EVALUATION

16. The engineering design analysis for the proposed harbor plans is presented in Appendix A, and detailed economic costs and benefits are presented in Table D-8. The economic, social and environmental effects of the four alternative plans have been assessed and evaluated, and a summarization of these evaluations is presented in Table D-9, Summary Comparison of Alternative Plans and System of Accounts. This table displays the significant contributions, beneficial and adverse effects, and the extent the significant contributions, beneficial and adverse effects, and the extent to which the planning objectives and evaluation criteria are met by each plan. A final plan selection will follow review of this draft project report and the draft environmental statement and a formal public meeting to be held in October 1977. All the public input will be considered in the plan selection and will be documented in the final project reports.

17. Additional section of this report to be completed after the public meeting and incorporated into the final report are:

THE SELECTED PLAN

ECONOMICS OF THE SELECTED PLAN

PLAN IMPLEMENTATION, CONCLUSIONS, AND RECOMMENDATIONS

TABLE D-8 ECONOMIC FEATURES OF ALTERNATE PLANS

	PLAN 1	PLAN 2	PLAN 3	PLAN 4
Project First Cost (1)	$360,000	$620,000	$680,000	$510,000
Federal	335,000	555,000	575,000	435,000
Non-Federal	25,000	65,000	105,000	75,000
Annual Charges at 6-5/8%				
Interest & Amortization	25,000	43,000	47,000	35,000
Maintenance	1,500	4,000	5,000	4,000
TOTAL	26,500	47,000	52,000	39,000
Average Annual Benefits at 6-5/8%				
Transit Time Savings	8,700	13,000	13,000	13,000
Lost Wages	26,200	39,400	39,400	39,400
Subsistence Fishing (2)	1,800	13,000	13,000	13,000
Damages to Boats, Lost Lives (2)	-	-	-	-
EDA	3,300	5,700	6,200	4,700
TOTAL	40,000	59,900	60,400	58,900
Benefit - Cost Ratio				
Without EDA Benefits	1.4	1.1	1.04	1.4
With EDA Benefits	1.5	1.2	1.2	1.5
Net Benefits				
Without EDA Benefits	10,200	7,200	2,200	15,200
With EDA Benefits	13,500	12,900	8,400	19,900

(1) Excluding Pre-authorization Study Cost of $83,000

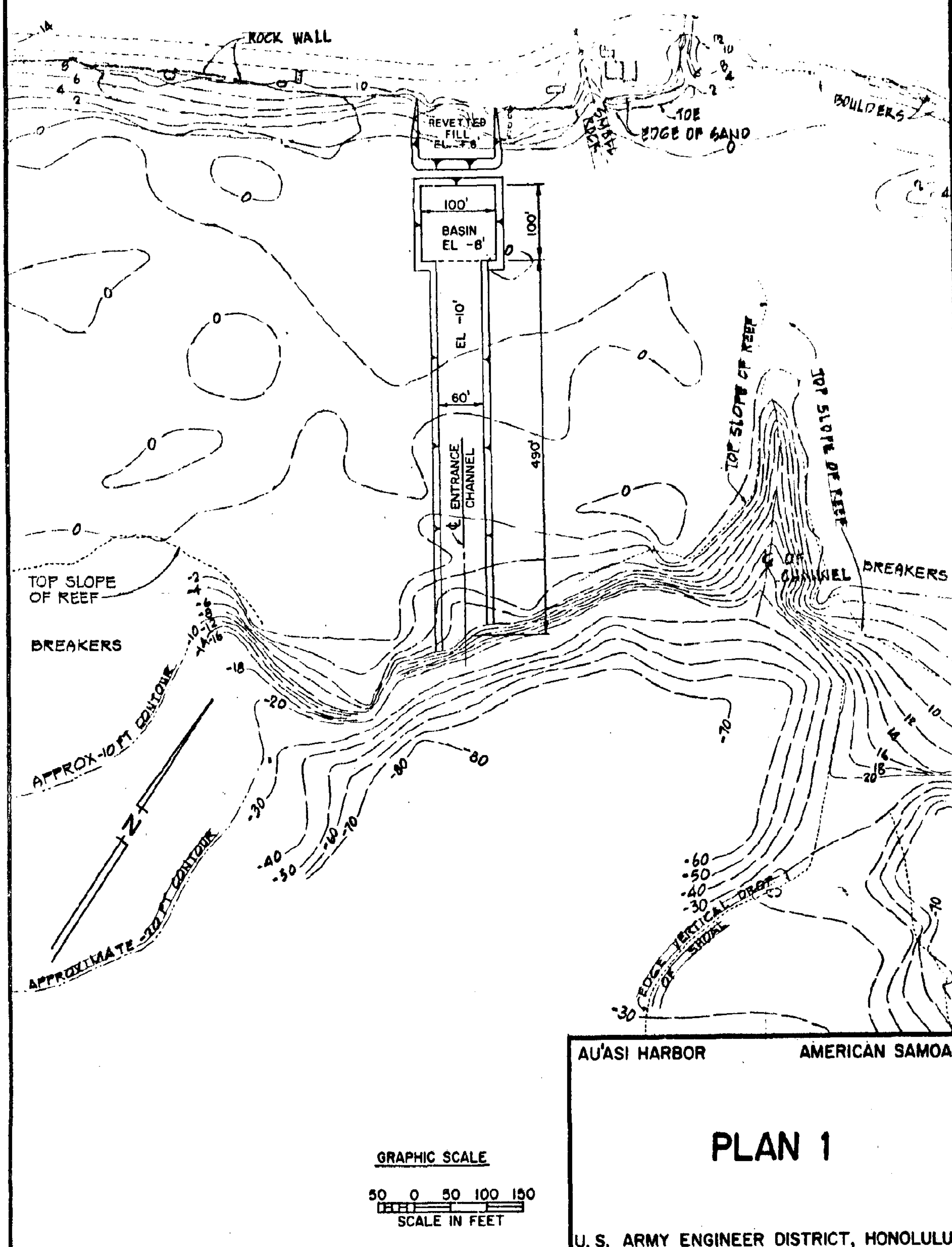
(2) Some additional commercial fishing activity will likely be realized as project benefits in the future, but due to insufficient data, these potential added benefits have not been quantified. It is also known that hazardous conditions (which will be largely eliminated with a project) have contributed to damages and lost boats, although available data for this is also inadequate for quantification.

TABLE D-9 - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

	PLAN 1	PLAN 2	PLAN 3	PLAN 4
A. PLAN DESCRIPTION	CONSTRUCTION OF A 60-FOOT-WIDE, 490-FOOT-LONG, 10-FOOT-DEEP ENTRANCE CHANNEL, A 10,000-SQUARE-FOOT, 8-FOOT-DEEP TURNING BASIN, AND A 7,000-SQUARE-FOOT REVETTED BACKUP AREA IN THE CENTRAL PORTION OF THE AUASI EMBAYMENT.	CONSTRUCTION OF A 60-WIDE, 430-FOOT-LONG, 10-FOOT-DEEP ENTRANCE CHANNEL, A 36,000 SQUARE FOOT, 8-FOOT-DEEP TURNING/MOORING BASIN, A 250-FOOT-LONG BREAKWATER, AND A 24,000-SQUARE-FOOT REVETTED HARBOR BACK-UP AREA IN THE CENTRAL PORTION OF THE AUASI EMBAYMENT.	CONSTRUCTION OF AN OFFSHORE HARBOR IN THE CENTRAL PORTION OF THE AUASI EMBAYMENT CONSISTING OF A 60-FOOT-WIDE, 280-FOOT-LONG, 10-FOOT-DEEP ENTRANCE CHANNEL, A 36,000 SQUARE-FOOT, 8-FOOT-DEEP TURNING/MOORING BASIN, A 330-FOOT-LONG BREAKWATER AND 190-FOOT-LONG REVETTED MOLE, AND A 265-FOOT-LONG REVETTED CAUSEWAY.	LOCATED AT THE EAST END OF THE AUASI EMBAYMENT IN THE VICINITY OF THE EXISTING NATURAL CHANNEL, THIS PLAN PROVIDES FOR CONSTRUCTION OF A 60-FOOT-WIDE, 370-FOOT-LONG, 10-FOOT-DEEP ENTRANCE CHANNEL, A 35,000-SQUARE-FOOT, 8-FOOT-DEEP TURNING/MOORING BASIN, A 110-FOOT-LONG REVETTED MOLE AND 170-FOOT-LONG BREAKWATER, AND A 33,000-SQUARE-FOOT REVETTED HARBOR BACKUP AREA.
B. SIGNIFICANT IMPACTS				
1. ECONOMIC				
a. TRANSIT TIME	DFCREASED BY 9,200 MAN-HOURS /YEAR	DECREASED BY 14,000 MAN-HOURS /YEAR	DECREASED BY 14,000 MAN- HOURS /YEAR	DECREASED BY 14,000 MAN-HOURS /YEAR
b. WAGE EARNING	INCREASED BY $26,200 /YEAR	INCREASED BY $39,400 /YEAR	INCREASED BY $39,400 /YEAR	INCREASED BY $39,400 /YEAR
c. SUBSISTENCE FISHING	INCREASED BY 7,500 LBS /YEAR	INCREASED BY 7,500 LBS /YEAR	INCREASED BY 7,500 LBS /YEAR	INCREASED BY 7,500 LBS /YEAR
d. DAMAGES, PERSONAL PROPERTY LOSS	SOME DECREASE DUE TO REDUCTION IN HAZARDOUS CONDITIONS	GREATER THAN PLAN 1	SAME AS PLAN 2	SAME AS PLAN 2
e. EARNINGS RECEIVED BY LOCAL WORKERS (OTHERWISE UNEMPLOYED) FROM EMPLOYMENT DURING CONSTRUCTION PERIOD.	$48,000	$82,000	$90,000	$68,000
2. ENVIRONMENTAL				
a. CHANGES TO THE MARINE ENVIRONMENT				
(1) REDUCTION OF HIGH CORAL COVERAGE REEF AREA (ACRES)	0.1	0.1	0.1	0.3
(2) CONVERSION OF SHALLOW WATER HABITAT TO DEEP WATER HABITAT	1.2	2	1.7	1.6
(3) CONVERSION OF SHALLOW WATER HABITAT TO HIGHER RELIEF INTERTIDAL HABITAT	900 FT^2	5100 FT^2	7600 FT^2	4800 FT^2
b. CHANGES TO WATER QUALITY AND CIRCULATION	ALL PLANS TEMPORARILY INCREASE TURBIDITY DURING CONSTRUCTION			
	CHANNEL AND BASIN CAUSE LOCALIZED CHANGE IN WATER CIRCULATION.	BREAKWATER, CHANNEL AND BASIN CAUSE LOCALIZED CHANGES IN WATER CIRCULATION	SAME AS PLAN 2	SAME AS PLAN 2
c. CHANGES TO BIOTA	SPECIES DIVERSITY AND ABUNDANCE WITHIN HARBOR CHANNEL AND BASIN WILL BE LOWER THAN THE REMAINDER OF NATURAL REEF FOLLOWING CONSTRUCTION.	SAME AS PLAN 1. INTERTIDAL ORGANISM WILL REPLACE SHALLOW WATER ORGANISM IN REEF AREAS COVERED BY THE BREAKWATER.	SAME AS PLAN 2	SAME AS PLAN 2
d. COMMITMENT OF NATURAL RESOURCES	400 CY OF ROCK FOR PROTECTIVE STRUCTURE.	3500 CY OF ROCK FOR PROTECTIVE STRUCTURE.	5600 CY OF ROCK FOR PROTECTIVE STRUCTURE.	3900 CY OF ROCK FOR PROTECTIVE STRUCTURE.
3. SOCIAL				
a. HEALTH, SAFETY, COMMUNITY WELL-BEING	INCREASES SAFTY FOR INTERISLAND TRAVELERS BETWEEN AUNU'U AND TUTUILA. WOULD CREATE NEW FISHING OPPORTUNITIES.	SAME AS PLAN 1. INCREASED PROTECTION FOR COMMUNITY OWNED VESSELS.	SAME AS PLAN 2	SAME AS PLAN 2
b. AESTHETICS	NO SIGNIFICANT CHANGE.	PROTECTIVE STRUCTURES AND HARBOR BACKUP AREA INTRODUCE NEW VISUAL ELEMENTS IN THE COASTAL ZONE.	SAME AS PLAN 2	SAME AS PLAN 2
c. COMMUNITY GROWTH/COHESION	IMPROVES ACCESS FOR AUNU'U ISLAND RESIDENTS TO JOBS, SCHOOLS, MARKETS, AND PUBLIC SERVICES ON TUTUILA. IMPROVED ACCESS FOR RESIDENTS AND VISITORS MAY INFLUENCE TRADITIONAL SAMOAN CULTURE ON AUNU'U ISLAND.	SAME AS PLAN 1	SAME AS PLAN 1	SAME AS PLAN 1

C. PLAN EVALUATION

	PLAN 1	PLAN 2	PLAN 3	PLAN 4
1. CONTRIBUTIONS TO PLANNING OBJECTIVES				
a. IMPROVE INTERISLAND TRANSPORTION	PROVIDES FOR SAFE NAVIGATION THROUGH THE REEF AND A FAIR WEATHER LANDING.	PROVIDES FOR SAFE NAVIGATION THROUGH THE REEF AND A SAFE LANDING AND PROTECTED MOORING DURING ALL BUT SEVERE STORM WAVE CONDITIONS. PROVIDES APPROXIMATELY 12 MOORING SPACES.	SAME AS PLAN 2.	SAME AS PLAN 2.
b. MINIMIZE IMPACTS TO MARINE ENVIRONMENT	PRESERVES 90% OF REEF.	PRESERVES 80% OF REEF.	PRESERVES 75% OF REEF.	PRESERVES 80% OF REEF.
c. ENGINEERING EFFECTIVENESS	ENTRANCE CHANNEL LOCATED IN AREA OF WAVE ENERGY DIVERGENCE. STRONG TIDAL AND/OR RIP CURRENTS WILL EXIST IN THE ENTRANCE CHANNEL. REVETMENT REQUIRED TO MINIMIZE SHORELINE RESPONSE TO DREDGED CHANNEL AND BASIN. MEETS ENGINEERING DESIGN CRITERIA.	SAME AS PLAN 1.	SAME AS PLAN 1, EXCEPT NO SHORELINE REVETMENT REQUIRED.	ENTRANCE CHANNEL LOCATED NEAR AREA OF WAVE ENERGY CONVERGENCE. NEARBY OFFSHORE SHOAL CONSTITUTES A NAVIGATION HAZARD FOR APPROACHING VESSELS DURING PERIODS OF HIGH WAVES. MEETS ENGINEERING DESIGN CRITERIA.
d. ECONOMIC JUSTIFICATION	BENEFITS EXCEED COSTS, SEE 2a.	SAME AS PLAN 1.	SAME AS PLAN 1.	SAME AS PLAN 1.
e. SOCIALLY ACCEPTABLE	TO BE DETERMINED FOLLOWING PUBLIC REVIEW OF PROPOSED PLANS			
2. RELATIONSHIP TO NATIONAL ACCOUNTS				
a. NATIONAL ECONOMIC DEVELOPMENT				
AVERAGE ANNUAL BENEFITS	$40,000	$59,000	$60,400	$58,900
AVERAGE ANNUAL COSTS	26,000	47,000	52,000	39,000
NET ANNUAL BENEFITS	13,000	12,900	8,400	19,900
B/C RATIO	1.5	1.3	1.2	1.5
b. ENVIRONMENTAL QUALITY	ALL PLANS RESULT IN A NET CHANGE TO THE MARINE ENVIRONMENT, SEE ITEM B2 FOR IMPACT NOTATION			
c. SOCIAL WELL-BEING	ALL PLANS RESULT IN A NET INCREASE IN SOCIAL WELL-BEING, SEE ITEM B3 FOR NOTATION			
d. REGIONAL DEVELOPMENT	DETAILED REGIONAL ANALYSIS NOT PERFORMED - STUDY AREA AND REGIONAL AREA EVALUATIONS NOT SEPERABLE			
3. RESPONSE TO EVALUATION CRITERIA				
a. ACCEPTABILITY	TO BE COMPLETED FOLLOWING REVISION OF PROPOSED PLANS			
b. CERTAINTY	HIGH	HIGH	HIGH	HIGH
c. COMPLETENESS	COMPLETE AS DESCRIBED	COMPLETE AS DESCRIBED	COMPLETE AS DESCRIBED	COMPLETE AS DESCRIBED
d. EFFECTIVENESS	EFFECTIVE ONLY DURING FAIR WEATHER	HIGHLY EFFECTIVE DURING ALL BUT SEVERE STORM CONDITIONS	SAME AS PLAN 2	SAME AS PLAN 2
e. EFFICIENCY	HIGH	ACCEPTABLE	ACCEPTABLE	HIGH, MAXIMIZES NET BENEFITS
f. REVERSIBILITY	NON-REVERSIBLE	NON-REVERSIBLE	NON-REVERSIBLE	NON-REVERSIBLE



AU'ASI HARBOR AMERICAN SAMOA

PLAN 1

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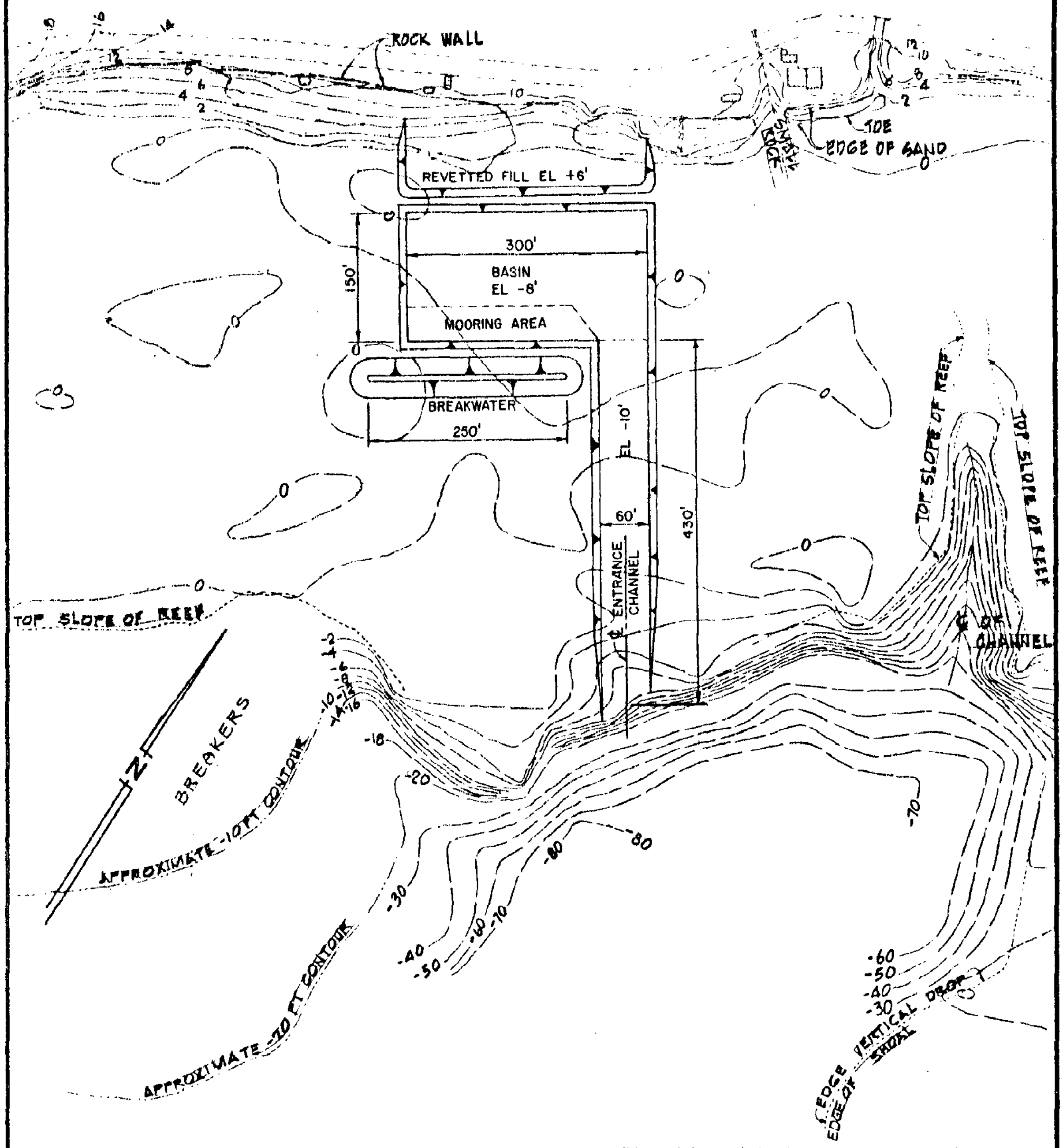
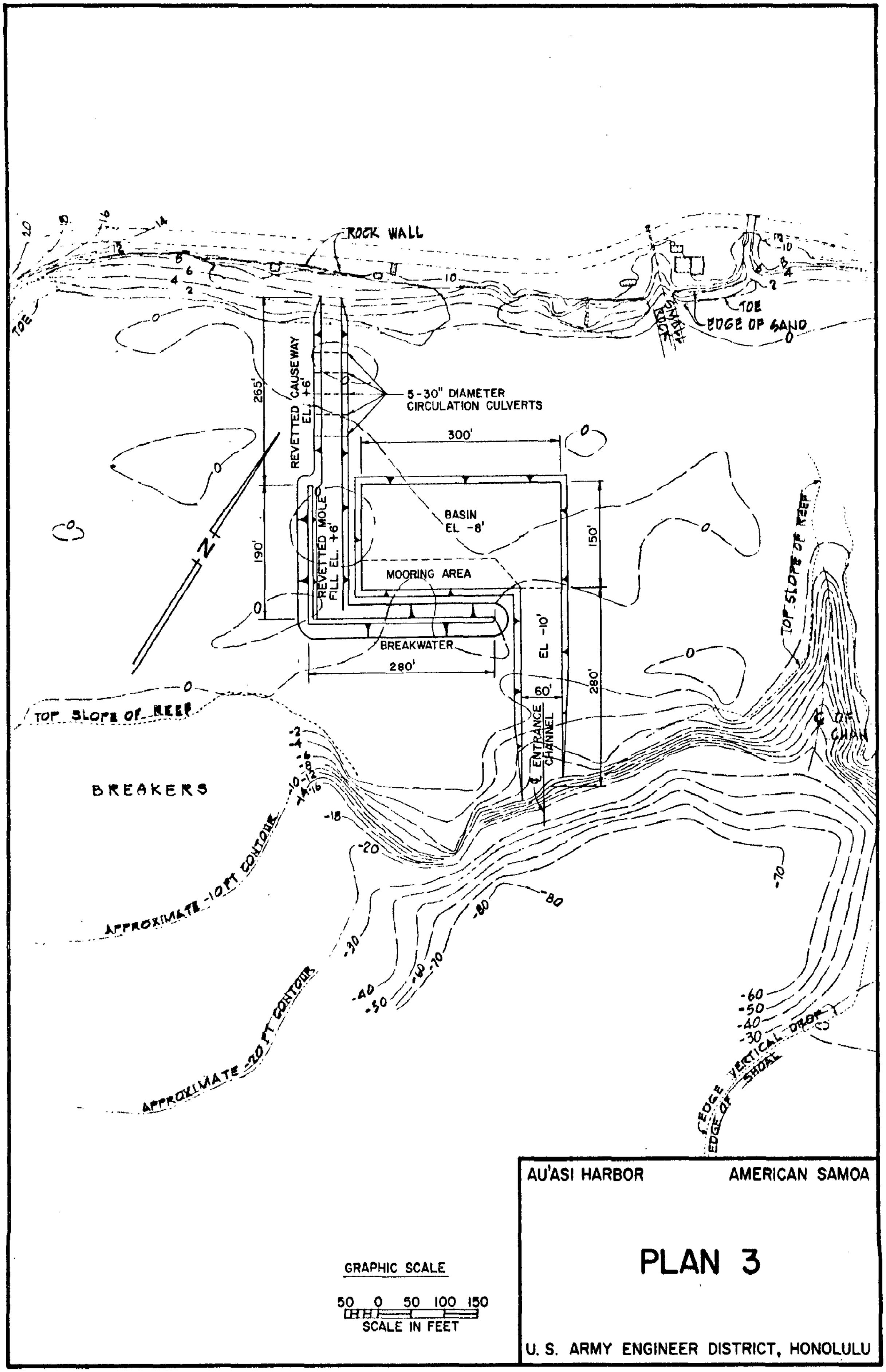


AU'ASI HARBOR — AMERICAN SAMOA

PLAN 2

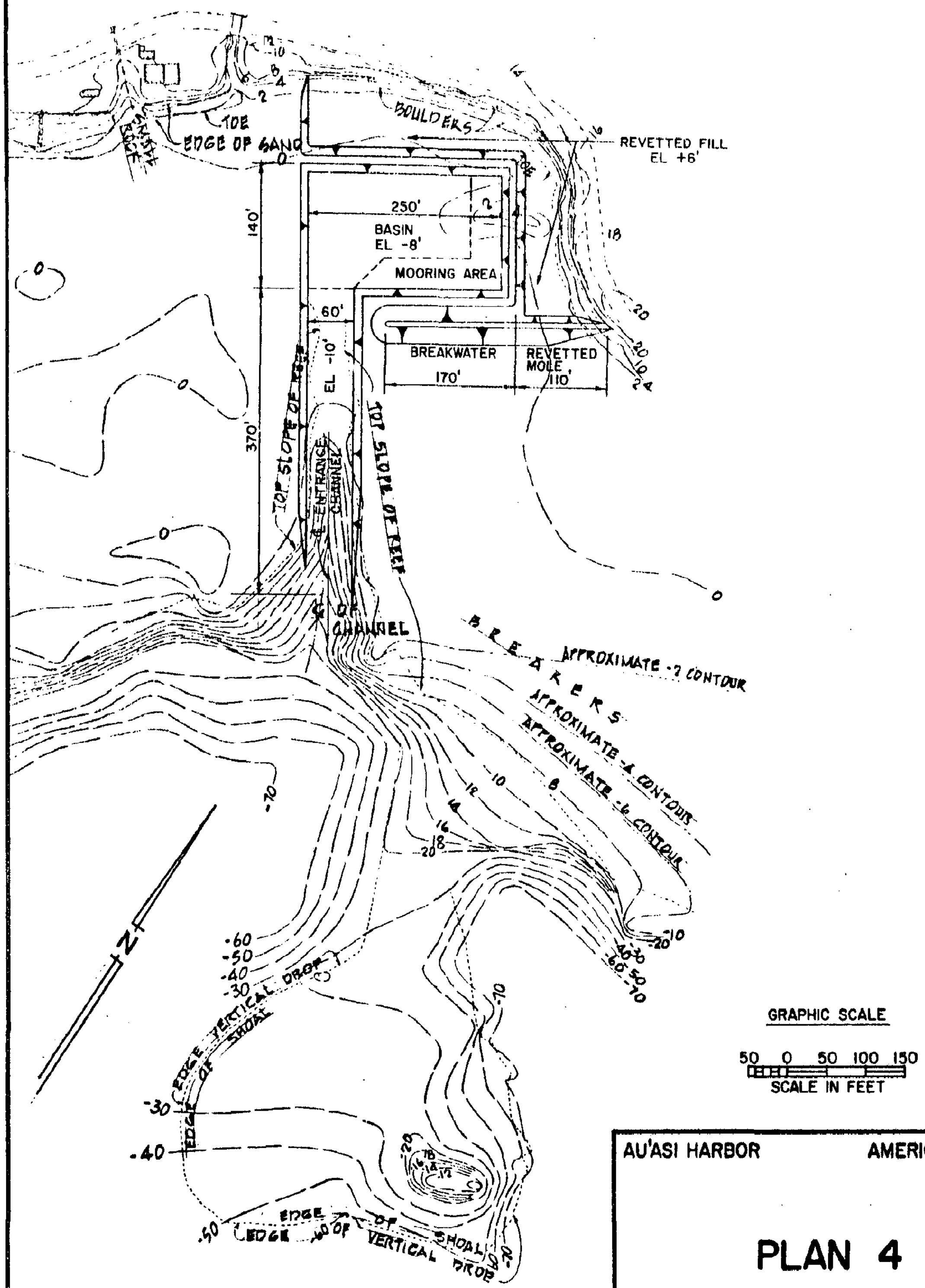
U. S. ARMY ENGINEER DISTRICT, HONOLULU



AU'ASI HARBOR AMERICAN SAMOA

PLAN 3

U. S. ARMY ENGINEER DISTRICT, HONOLULU



AU'ASI HARBOR AMERICAN SAMOA

PLAN 4

U. S. ARMY ENGINEER DISTRICT, HONOLULU

APPENDIX I

DESIGN ANALYSIS

AUASI HARBOR

DESIGN APPENDIX

1. Design Considerations

a. The harbor is designed to moor and dock a 40-foot utility vessel during calm and marginal (stormy, but not hurricane) weather conditions. Therefore, vessels normally moored at Auasi will move to safe, well-protected harbors at Pago Pago or the proposed barge harbor at Aunu'u during tropical storms and hurricanes. Nevertheless, the harbor structures must not fail during these storms. The protective structures, while not providing protection during these periods, must withstand the high wave attack and heavy overtopping that would occur during these storms.

b. Because all of the harbor alternatives would be constructed on the reef flat, calculations of the design wave that would attack the structures were based on controlling depth criteria.

2. Possible wind-wave periods and heights at Auasi (during normal wind conditions). Given the (a) surface wind diagram at Pago Pago Airport (Figure B-2), (b) the exposure chart for deep ocean swells (Figure B-3), and Figure 3-15 in the Shore Protection Manual (Wave Forecasting Curves), the following hindcast data were developed:

Deepwater Wave Direction	Assumed Wind Velocity (knots)	Assumed Fetch Length (nautical miles)	T sec.	H ft.
SW	15	Unlimited	5.5	6'
S	20	Unlimited	7	10'
SSE	30	Unlimited	10	20'
SE	30	1	3	2'
E	30	Unlimited	10	20'

The above values were calculated assuming an unlimited wind duration.

In addition, Table 1 in the main test of the report shows annual sea and swell conditions that could be expected at Auasi.

2.1 Based on the above data, sea or swell at Auasi over 4 or 5 feet in height is a rare occurrence. This is more evident when one realizes the high refraction and diffraction that waves undergo approaching from the predominant directions of E to S due to the presence of Aunu'u Island and Nafanua Bank south of Auasi. Auasi is also exposed to the southwest, but winds and waves from that direction are also rare.

2.2 For the purpose of designing the entrance channel and basin, a design wave 4 feet in height with a period of 10 seconds was selected. Based on observations by Corps personnel and interviews with local residents, waves larger than 4 feet in height in the specific area where an entrance channel could reasonably be constructed (between the existing entrance channel to 500 feet SW of the existing channel) are rare. At the extreme ends of this area, where shoal areas exist, focusing of wave energy occurs and, therefore, higher waves are more frequent.

3. Design Hurricane (for determination of design still water level, SWL). Calculate deep water significant wave height, H_o, and period, T_s, that would be generated by the design hurricane. (Ref pg. 3-57, 58, SPM). The characteristics of the design hurricane are as follows (Ref. Aunu'u Harbor DPR):

a. Central pressure, P_o = 27.87 inches Hg.

b. Radius of max winds, R = 45 nautical miles.

c. Forward speed of translation, V_f, = 8 knots

$f = 2w \sin \phi$ = coriolis force

w = angular velocity of earth = $\frac{2\pi}{24}$ rad/hr

ϕ = latitude of Samoa = 14°S

f = 0.127

U max = maximum wind speed

U max = 0.868 [73 (Pn-Po) - R(0.575f)]

where Po = normal atmospheric pressure = 29.92 inches of mercury

U max = 88 knots

U_R = maximum sustained wind speed

= 0.865 U max + 0.5 V_f

where V_f = forward speed of the hurricane

U_R = 80 knots

Then,

$$Ho = 16.5\ e^{\frac{(Pn-Po)\ R}{100}} \left[1 + \frac{0.208 V_f}{\sqrt{U_R}}\right]$$

Ho = 49 feet

$$\text{and } Ts = 8.6\ e^{R\Delta P/200} \left[1 + \frac{0.104\ V_f}{\sqrt{U_R}}\right]$$

Ts = 15 seconds

Assuming a hurricane approaching from the south, a wave of height 49' and period 15 sec. will be generated. As these waves approach Auasi, they will be attenuated over the Nafunua Bank in a manner described in SPM section 7.23. This attenuation can be calculated by using Eq. 7-10, SPM.

$$\frac{Ht}{Hi} = \left[1 - \frac{(4\pi h/L) + \sinh(4\pi h/L)}{\sinh(4\pi d_s/L) + (4\pi d_s/L)}\right]$$

where H = height of shoal above the bottom = 240 feet

d_s = depth below SWL at the Shoal toe = 300 feet

L = deep water wave length = $\frac{gT^2}{2\pi}$ = 1150 feet

Therefore,

$$\frac{Ht}{Hi} = 0.66, \quad Hi = Ho = 49 \text{ feet}$$

$$Ht = 0.66\ Ho = 32 \text{ feet}$$

The wave period will not change.

4. Calculation of SWL.

The reference elevation is Mean Low Water (MLW).

$ds = Si + Sa + Sap + Sw + Ss$

$SWL = Sa + Sap + Sw + Ss$

a. Si = initial water level on reef = 0.

b. Sa = astronomical tide = 3.0'

MHW = 2.5', highest tide observed = 4.2'

c. $S_{\Delta p}$ = water level rise due to atmospheric pressure reduction

$S_{\Delta p} = 1.14\ (Pn - Po)\ (1 - e^{-R/r})$

$S_{\Delta p} = 2.34\ (1 - e^{-R/r})$

r = radial distance from storm center to computation point.

Assume r = 10 nautical miles almost the worst condition

$S_{\Delta p}$ = 2.3' (See Figure 1).

d. S_w = water level rise due to wave setup

Assume S_w = 0.5'

e. S_s = storm surge

An approximation of S_s can be obtained by:

$\Delta S_s = \dfrac{540k\ U_r^2\ X}{\bar{d}}$ (Tech. Report No. 4, pg. 1-64)

where $k = 3 \times 10^{-6}$

Ur = 80 knots

X = incremental distance in n.m.

$\bar{d}$ = mean depth over the increment (feet)

X	X	d*	$\bar{d}$	S_s
2.15		600		
	.25		330	.0786
1.9		60		
	.24		50	.498
1.66		60		
	.25		180	.144
1.31		300		
	.33		310	.110
.98		300		
	.29		330	.091
.69		240		
	.56		120	.484
.13		0		
		Total surge S_s		1.41'

*Profile along range directly south of Auasi (See Figure 2).

Therefore ds = Si + Sa + Sap + Sw + Ss

= 0 + 3.0 + 2.3 + 0.5 + 1.4

ds = 7.2 feet

5. Calculation of Design Wave Height

Design wave height is based on controlling depth criteria.

Assume m, nearshore slope, equals zero seaward of any structure that might be built on the reef flat.

$H_b = 0.78\ d_s = 0.78\ (7.2) = 5.6$

$H_b = 5.6'$ (Ref SPM, Figure 7-4)

6. Breakwater Design (for structures under attack by the maximum design wave).

6.1 Weight of Armor Stone

$$W = \frac{Wr\ H^3}{K_D\ (S_r - 1)^3 \cot\theta}$$

Wr = 170 lb/cubic ft

Sr = 2.66

$\cot\theta = 2.0$

K_D = 2.5 (head section) and 3.5 (trunk)

$H = 5.6'$

$W = 1300$ pounds (head section)

$= 930$ pounds (trunk section)

	$W = 0.5\text{-}1.0$ tons average dimen 2.4'
STONE SIZE	underlayer: 100 to 500 lb - average dimen, 9 inches core: dredged material (if necessary)

7. Run-up Analysis

Basis: Previous Samoa DPR's

a. Ta'u DPR

$T = 18$ sec, $H = 7'$, $R = 10.4'$, $d_{SWL} = 5''$, Crest selected = 13'

$$\frac{R}{H} = \frac{10.4}{7} = 1.49$$

b. Ofu DPR

$T = 8$ sec, $H = 6.2'$, $R = 7.5'$, $d_{SWL} = 6.9'$ MSL, crest selected = 14.5'

$$\frac{R}{H} = \frac{7.5}{6.2} = 1.21$$

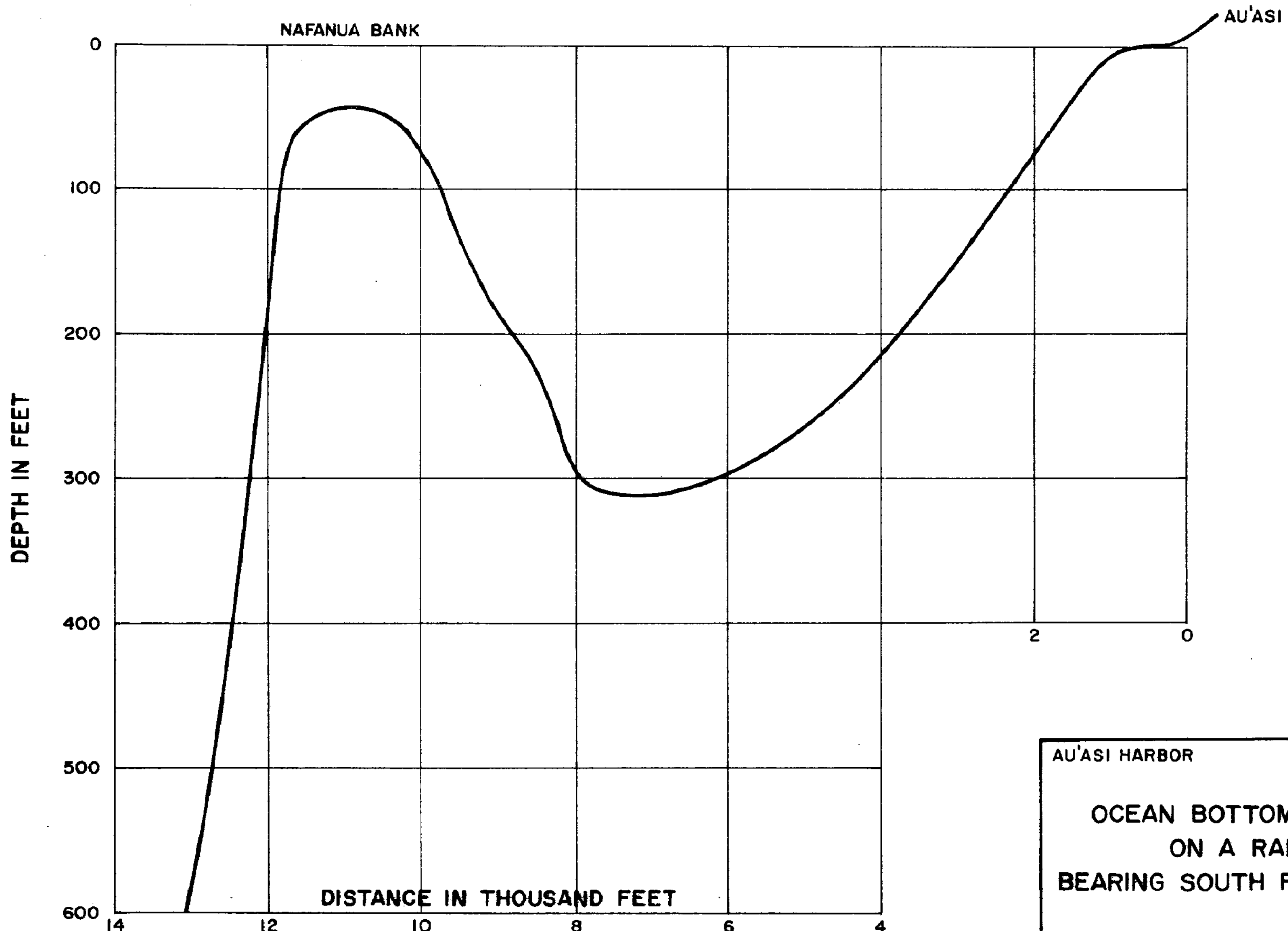
c. Aunu'u DPR

$T = 5\text{-}6$ sec, $H = 6.9'$, $R = 6.2$, $d_{SWL} = 5'$, crest selected = 11.5'

$$\frac{R}{H} = \frac{6.2}{6.9} = 0.90$$

8. Crest Elevation. Based on existing information 1/ and discussions with personnel at the Waterways Experiment Station, and in light of the

1/ WES Research Report No. 2-11, "Design of Rubblemound Breakwaters subjected to non-Breaking Waves," 1968.
Recent wave flume tests by WES for the proposed Lahaina Small Boat Harbor, Maui, Hawaii, 1975.



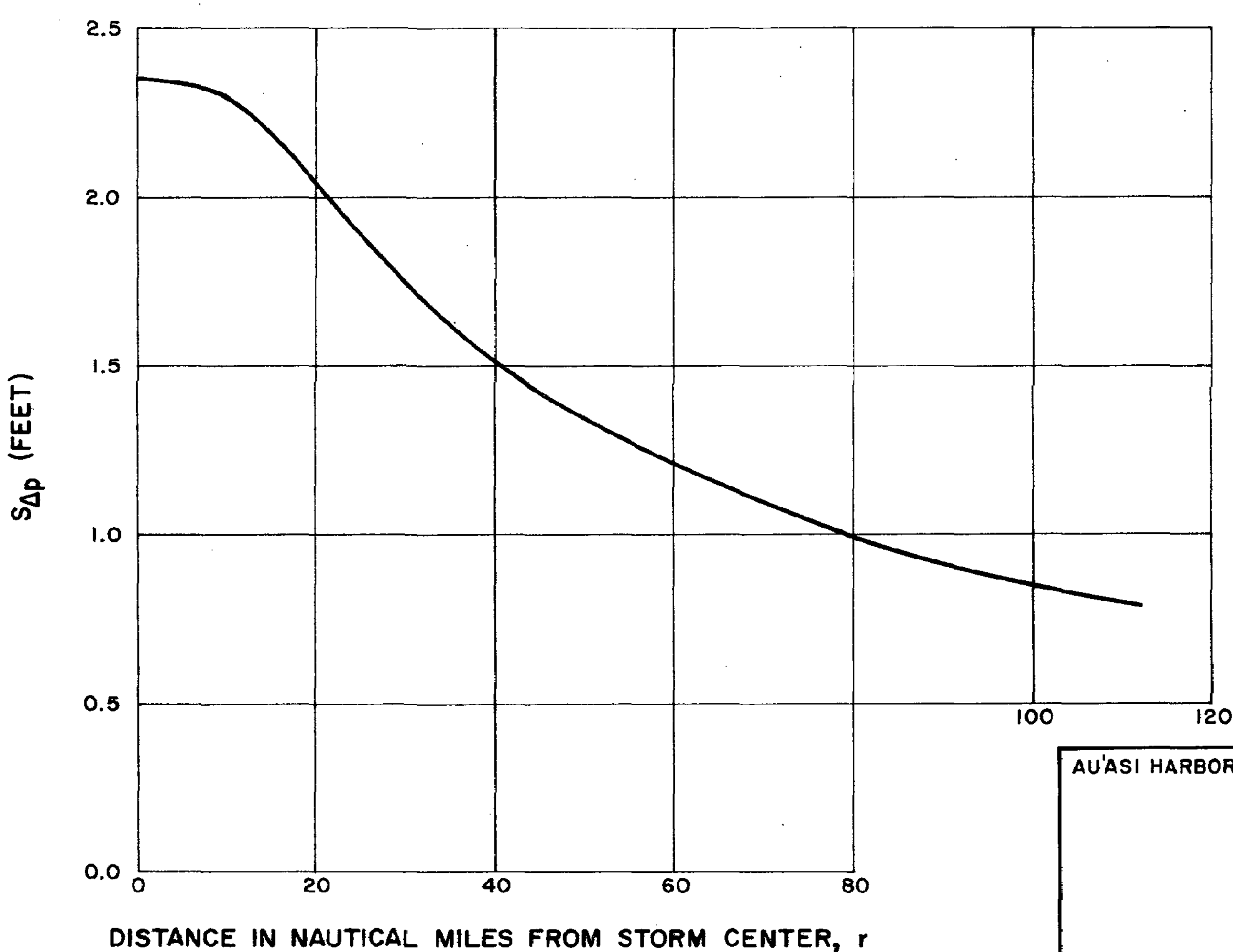
AU'ASI HARBOR AMERICAN SAMOA

OCEAN BOTTOM PROFILE
ON A RANGE
BEARING SOUTH FROM AU'ASI

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 2

FIGURE 2



AU'ASI HARBOR AMERICAN SAMOA

$S_{\Delta p}$ VS. r

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 1

FIGURE 1

previously used R to H ratios and the natural protection of the Auasi area, a runup (R) to design breaker height (H_b) ratio of 1.3 is estimated for breaking waves approaching parallel to a rubblemound structure.

Therefore, $\frac{R}{H} = 1.3$

was chosen to describe runup at Auasi.

$$R_{SWL} = 1.3\ (H) = 1.3\ (5.6) = 7.3$$

$$R_{MLW} = 7.2 + 7.3 = 14.5'$$

For economic reasons and the assumption that the harbor will not be used during extreme storm conditions, a breakwater crest elevation of 10.0' MLW was selected. This crest elevation will be overtopped during extreme storm conditions.

9. Channel and Turning/Mooring Basin Design.

1. The entrance channel and turning/mooring basin are designed to accommodate vessels up to a length of 40 feet, a beam of 12 feet, and a draft of 4 feet. The criteria represents the dimensions of a loaded utility vessel or fishing boat, which are the largest vessels anticipated to use the harbor.

2. The channel and basin depths are designed based on the assumption that boats will not be using the channel and basin during maximum wave conditions. As stated in paragraph 2, for the purposes of channel and basin design, a wave of 4 feet in height and 10-second period was selected.

9.1 Channel Design.

TABLE 1. ENTRANCE CHANNEL DEPTH CRITERIA

Draft of Design Vessel	4.0 feet
Estimated Minimum Tide Below MLW	1.0 feet
Allowance for Vessel Behavior (aquat, trim)	1.0 feet
Allowance for Wave Action (2-foot trough)	2.0 feet
Bottom Clearance	2.0 feet
TOTAL	10.0 feet

a. Based on the above tabulation, an entrance channel depth of 10.0 feet was selected.

b. Channel width (assuming one-way boat traffic)

W = 3 x design beam x 1.5 (allowance for wave action)

W = 60 feet

9.2 Basin Design

TABLE 2. BASIN DEPTH CRITERIA

Draft of Design Vessel	4.0 feet
Estimated Minimum Tide below MLW	1.0 feet
Allowance for Wave Action (1-foot trough)	1.0 feet
Bottom Clearance	2.0 feet
TOTAL	8.0 feet

a. A basin depth of 8 feet was selected based on the tabulation above.

b. Minimum basin dimension. To allow for the maneuverability of the design vessel in the restricted basin area, a minimum basin dimension is required. This minimum is normally defined as:

Dmin = 2.5 x design vessel length

Dmin = 100 feet

ATTACHMENT I

DRAFT ENVIRONMENTAL STATEMENT

DRAFT
ENVIRONMENTAL STATEMENT
AUASI SMALL BOAT HARBOR
AMERICAN SAMOA

SUMMARY

(X) Draft ( ) Final Statement

Responsible Office: US Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858
Telephone: (808) 438-1091

1. Name of the Action: (X) Administrative ( ) Legislative

2. Description of Alternatives. A Small Boat Harbor Project at Auasi has been planned by the Federal Government and Government of American Samoa to provide a safe and efficient landing and mooring for commuter and small boats traveling between the islands of Tutuila and Aunu'u. The alternatives considered to accomplish the planning objectives include four small harbor designs. Plan 1 provides for an access channel and inshore turning basin. Plan 2 provides for an access channel, an inshore turning/mooring basin protected on its seaward margin by a breakwater, and a revetted docking area. Plan 3 is similar to Plan 2, but provides for a shorter access channel connected to a mid-reef turning/ mooring basin protected on its seaward margin by a breakwater, and a docking area connected to shore by a causeway incorporating circulation culverts. Plan 4 provides for the deepening and widening of an existing channel through the reef and dredging an inshore turning/mooring basin to be protected by a breakwater connected to a revetted mole docking facility.

3. Environmental Impacts. Each of the proposed alternative plans will require dredging of the reef platform and filling of reef flat area, with the exception of Plan 1 which involves only dredging. The net loss of existing reef habitat resulting from each of the plans is: 1.2 acres for Plan 1; 2.5 acres for Plan 2; 3.2 acres for Plan 3; 2.3 acres for Plan 4. Marine organisms in the dredged and filled areas would be killed. Reduction in reef flat area represents a loss of spawning/ nursery and food-production areas, however, population balance of marine organisms in adjoining and neighboring reef areas will not be affected. The dredging would create new subtidal habitats for surviving and colonizing organisms and pelagic offshore fishes, and will provide new fishing opportunities. However, organism abundance and diversity in the dredged areas are expected to be lower than the surrounding undisturbed reef areas. Breakwater and revetted surfaces will also provide additional intertidal habitats. Localized changes in water circulation over

the reef platform are anticipated, but there will be no change to the excellent tidal exchange-water velocity characteristics on the remainder of the reef platform. Dredging will temporarily increase water turbidity and create artificial fish feeding conditions. Sedimentation in the dredged areas will stress and destroy organisms having low tolerance to silting. Blasting in conjunction with dredging operations will destroy and damage both sessile and motile marine organisms in the vicinity of the blast area. Construction would create temporary traffic and noise inconveniences and intrusions at Auasi, temporarily disrupting normally quiet daily living conditions. Improved landing safety will reduce the loss of life and property at Auasi. If sea transportation modes, frequency, and reliability are improved, the harbor may contribute to existing socio-economic trends in the Territory and may result in localized socio-economic changes at Auasi.

4. Adverse Environmental Impacts. The destruction of marine organisms and habitat, and temporary traffic and noise inconveniences and disturbances resulting from construction activities are unavoidable.

5. Alternatives. Other alternatives considered included no-action, a bridge between Tutuila and Aunu'u Islands, increased use of motorized boats, and relocating the villagers at Aunu'u.

6. Comments requested from:

US Department of the Interior
US Department of Commerce
US Environmental Protection Agency
US Department of Transportation
US Department of Agriculture
US Department of Housing and Urban Development
US Department of Health, Education and Welfare

Office of the Governor, American Samoa
Department of Public Works, Government of American Samoa
Office of Marine Resources, Government of American Samoa
Environmental Coordinator, Office of the Governor, American Samoa

Village leaders of Aunu'u and Auasi.

7. Draft Statement to CEQ on 30 September 1977.

SECTION 1

DESCRIPTION OF ALTERNATIVE PLANS

SECTION I

1. DESCRIPTION OF THE ALTERNATIVE PLANS.

1.1 Based on the preliminary screening, analysis and initial coordination efforts, four plans have been developed to improve navigational safety at Auasi. Three plans provide for boat access and a mooring facility on the central portion of the Auasi reef platform with an entrance channel located approximately 325 feet southwest of the mouth of an existing natural channel in the reef flat. The fourth plan provides a boat access and mooring facility in the northeastern portion of the reef platform by improving the existing channel. The harbor will serve primarily commuter traffic improving navigational access and safety through the channel and providing a temporary mooring area for commuter boats. During severe storms boats in the mooring area will have to be moved to safe mooring at Pago Pago Harbor or the proposed Aunu'u Harbor. A summary of project alternative benefits and costs is presented in Appendix A.

Alternative Plan 1.

1.2 This plan provides for: (a) a 60-foot wide, 490-foot long, 10-foot deep entrance channel; and (b) a 100-foot square turning basin at the shoreward end of the entrance channel with a water depth of 8 feet below mean low water. The plan will require a reef area of approximately 1.2 acres or approximately 10 percent of the reef platform, and dredging 16,000 cubic yards of coralline reef material.

Alternative Plan 2.

1.3 This plan provides for: (a) a 60-foot wide, 430-foot long, 10-foot deep entrance channel; (b) a turning and mooring basin 150-foot wide and 300-foot long with a depth of 8 feet below mean sea level; and (c) a 250-foot long, 50-foot wide stone breakwater with an elevation of +10 feet above mean low water. The plan will require a reef area of approximately 2.5 acres or about 20 percent of the reef platform, and dredging 27,000 cubic yards of coralline reef material. Approximately 2,900 cubic yards of rock will be needed for the breakwater.

1.3.1 A docking facility approximately 300 feet long will extend from 50 to 75 feet out from shore and will have an elevation of approximately +8 feet above mean low water. The docking facility will be a revetted fill constructed simultaneously with the dredging of the channel and basin, and by using the dredged material as fill. Approximately 700 cubic yards of quarried rock and 4,000 cubic yards of dredge coralline material will be used in constructing the revetted fill. The Government of American Samoa will be responsible for financing construction of the docking facility.

Alternative Plan 3.

1.4 This plan is similar to Plan 2 except that (a) the length of the entrance channel is shortened by 150 feet, and (b) the turning/mooring basin is located in the middle of the reef platform. A revetted causeway with an elevation of 6 feet above mean low water will be built on the reef platform, and will extend 265 feet out from shore. The causeway will have a width of 50 feet before broadening on the seaward end to form a revetted mole 85 feet wide and 190 feet long. The revetted mole will be connected to the breakwater.

1.5 The plan will require approximately 3.2 acres or about 25 percent of the reef platform at Auasi, and dredging 22,500 cubic yards of coralline reef material. In addition, approximately 2,700 cubic yards of quarried rock will be needed for the breakwater. The causeway will require approximately 900 cubic yards of rock, and the revetted mole approximately 2,000 cubic yards of rock. Approximately 3,200 cubic yards of dredged material will be used as fill in the construction of the causeway and mole. Five 30-inch diameter circulation culverts will be placed under the causeway to maintain circulation through the causeway and along the shore.

Alternative Plan 4.

1.6 This plan provides for: (a) a new, 60-foot wide, 370-foot long and 10-foot deep entrance channel starting at the 10-foot depth contour in the existing natural channel and terminating as (b) a rectangular turning and mooring basin 140 feet wide, 250 feet long and 8 feet deep extending nearly to shore at Maatulaumea Point. Protection against wave action will be provided by a 170-foot long, 50-foot wide breakwater and a 110-foot long revetted mole. A revetted fill area will be constructed shoreward of the basin to provide harbor docking facility.

1.6.1 The reef will require 2.3 acres of reef area or about 19 percent of the Auasi reef platform, and dredging of 19,000 cubic yards of reef material. Approximately 6,500 cubic yards of dredge spoil will be used as fill to construct the revetted mole. Approximately 3,900 cubic yards of rock will be needed to construct the interior and exterior revetments and breakwater.

Other Construction Features.

1.7 The rock required for the revetments and breakwaters will be transported to Auasi from either an existing or new quarry site, or field stone on Tutuila. The quarry sources will be designated by the Government of American Samoa. Dredged material not utilized during construction will be stockpiled on Tutuila Island at a location specified by the Government of American Samoa to be used later for future construction activities.

1.8 Construction mobilization, staging, and storage areas around Auasi village will require approximately 3 acres of land. The use of any particular site and the reef areas during construction will be negotiated with the village residents and respective property owners. No village residents are expected to be displaced.

SECTION 2

ENVIRONMENTAL SETTING WITHOUT THE WATER RESOURCES PROJECT

2. ENVIRONMENTAL SETTING WITHOUT THE WATER RESOURCES PROJECT.

2.1 Auasi, site of the proposed project, lies along the southeastern coast of Tutuila Island approximately 1.2 miles from the offshore island of Aunu'u and between the coastal villages of Amouli to the southwest and Utumea to the northeast. Pago Pago, the center of government, population and commerce, is 15 road miles southwest of Auasi, but 8 miles by sea from Aunu'u. Auasi is located 14°16' South Latitude, 170°34' West Longitude. Auasi is bounded by two headlands, Taugamelama Point on the southwest and Maatulaumea Point on the northeast. The straight-line distance between these two points is approximately 1,900 feet. A well developed reef platform is present with a major natural drainage channel situated closer to the northeastern side of the bay.

Geology and Topography.

2.2 Tutuila Island is the top of a composite volcanic rising some 3 miles from the ocean floor. Interpretive studies indicated that Tutuila was formed of five volcanoes located over two- to three-parallel rifts trending N 20° E. Although young geologically, the island is not volcanically active. The predominant rock types are basaltic with lesser amounts of trachyte and andesite. The bulk of the volcanic rocks appears to be Pliocene or early Pleistocene in age. Recent basaltic tuffs and lavas have formed a broad, flat plain on the southwest side of the island from Tafuna to Leone. Recent sediments consist of talus, alluvium, calcareous sand, coralline gravel, and reef rock. The headlands at Auasi are basaltic with numerous boulders of various sizes at their bases. Three vertical basalt dike outcrops form ridges varying in length from 1,000 to 1,500 feet and are located 3,000 to 5,000 feet west of Auasi. The rock outcrops have hard, dense, widely spaced joint systems 50- to 75-foot thick that rise 100 feet or more above sea level. The softer rocks on both sides of the dikes have been weathered away leaving the hard basalt to form the ridges, (reference No. 2). At Auasi, post-Pleistocene age rock and alluvium are present (reference No. 3).

2.3 Two short valleys located in the northeast part of Auasi extend inland approximately 1,000 feet and 750 feet from the road up to the 200-foot elevation. The two valleys are separated by Tiatele Ridge. Leafu Stream occurs at the base of the more westerly and deepest of the two valleys, while Vaisa Stream occurs at the base of the more easterly valley. The waterways are examples of incised valley streams draining in a radial pattern away from the high volcanic peak of Olomoana Mountain (reference No. 3). Steep ridges - Taugasega Ridge on the southwest extending to Taugamalama Point, and Motusaga Ridge to the northeast with an extension forming Maatalaumea Point - separate Auasi from adjacent coastal areas.

2.4 The embayed shoreline between the headlands consists of sandy material of reef origin. A sand beach is much better developed in the south-southwest sector of the bay than the northeastern section. Beach rock occurs as isolated outcrops along the shoreline. A narrow strip of land, extending inshore approximately 100 to 150 feet from the waterline, is bordered by a modern paved road. Trees and other vegetation, a house, a raised platform, and an open "fale" (traditional Samoan dwelling) of recent construction, are located on the narrow strip of land.

Hydrology.

2.5 Streamflow in American Samoa is highly dependent on rainfall. The rainfall is highly variable from month to month. Rainfall recorded at Pago Pago Airport and several village stations on Tutuila and stream runoff recorded at six gaging stations on Tutuila indicate that only a small amount of the total precipitation percolates through the basalt to recharge the groundwater, except the Tafuna Plains area. Water supplies in American Samoa come from both high-level and basal (a major body of groundwater floating on and in equilibrium with saltwater) sources. High-level groundwater is stored in complex geologic dike structures where seepage forms the basis for many surface streams (reference No. 3).

2.6 At Auasi, there are both a stream gaging station and primary catchment and reservoir system (reference No. 3). Both Leafu and Vaisa Streams are intermittent, and no flow was observed by the Bishop Museum during a biological survey covering a 7-day period in March-April 1977. However, in mid-December 1976, water was observed flowing to the sea through the Auasi Stream (Auasi Stream is that part of the Leafu Stream that runs through Auasi Village). Auasi Stream is spring-fed, but the discharge volume and whether the stream is perennial are not known. The flow of water to the sea in Auasi Stream is probably regulated by catchment and reservoir system. Lowered salinities measured nearshore in March 1977, in the northeastern part of Auasi, indicated subaerial seepage along the shoreline.

Natural Forces

2.7 The climate of American Samoa is tropical with an average annual temperature range of 70°-90°F. Humidity ranges from 80 to 85 percent. The prevailing winds throughout the year are the easterly trades. Moderate trade winds tend to approach Samoa directly from the east during December and March and predominantly from the southeast throughout the rest of the year. The highest rainfall occurs from December to March. The average rainfall at Pago Pago International Airport is 130 inches a year, and the crest of the mountain range on Tutuila receives more than 250 inches a year. Although localized weather conditions may vary on the island at any given time, the long-term climatic pattern at Auasi differs little from that observed at other coastal areas in American Samoa.

2.8 Hurricanes and storms have damaged agricultural crops, roads, and homes in the Samoa Islands. Samoa lies across the path of tropical cyclones including hurricanes which generally move into the area from the north, but occasionally from the east, southeast, or west. The hurricane season occurs primarily between the months of November and April.

2.9 The prevailing wave direction is similar to the prevailing wind direction. Between June and November, approximately 80 percent of the waves along the Tutuila southern coast are produced by swells from the east and southeast. For the rest of the year, about 75 percent of the waves are produced by swells from the northeast, east, and southeast. The Auasi coastline is protected from waves approaching from the west clockwise to the northeast by the Tutila Island landmass and is somewhat protected from the southeast by Aunu'u Island. Refraction diagrams indicate that waves approaching from the east are greatly attenuated by local bathymetry. Auasi is most vulnerable to open-ocean swells and waves approaching from the south and southwest. Waves 6- to 8-feet in height, generated by a southerly swell, were observed at Auasi during a 5-day period between March and April 1977. The offshore reef slope and reef bathymetry cause wave height and direction to be irregular and make navigation into the existing channel unpredictable, difficult or impossible at times.

2.10 There are no tide gages at Auasi. Because of Auasi's close proximity to Pago Pago, tidal data from Pago Pago are considered applicable to Auasi. Two high and two low tides occur daily. The tidal data from the U.S. National Ocean Survey station at Pago Pago, referenced to mean low water reveal a mean high water of 2.5 feet, a mean low water of 0.0 foot, and a mean tide level of 1.2 feet with lowest tide expected at -2.0. Tide charts for the Pago Pago area in March and April 1977 showed a maximum daily spring tide range from a high of 3.7 feet to a low of -0.2 foot, a difference of 3.9 feet. The average mean and spring differences for Pago Pago are 2.5 and 3.1 feet, respectively.

2.11 Earthquakes occur infrequently on Tutuila. Recently, one was felt in Pago Pago area on the evening of 31 March 1977. The epicenter was several hundred miles from Tutuila. A tsunami resulting from a 1960 Chilean earthquake produced a runup of 4.5 feet at the entrance to Pago Pago. No report of tsunami activity affecting Auasi could be found.

Terrestrial Environment.

2.12 The terrestrial vegetation of American Samoa consists of various botanical communities. Dense tropical rain forest covers approximately 70 percent of the island of Tutuila, attaining a coverage as high as 90 percent on the Manu'a Islands. Tutuila has a less tropical rain forest area because of the higher level of human-related activities. Tutuila is the population and economic center of all of American Samoa. As a result, a higher incidence of land-clearing activities related to agriculture, transportation, housing, and economic development occur on the island. Taro and bananas are American Samoa's most important cash crops. They are grown in small plots for a maximum of two seasons, after which the plots are allowed to revert back to forest in order to regenerate lost soil nutrients. Small commercial plantations also grow breadfruit, sugarcane, and coconuts.

2.13 The vegetation in the Auasi area, between the road and the shoreline, consists of several kinds of trees including coconut, Futu, Fetau, Fau, Gatae, Milo, Papaka, Pua, and Tau, beach morning glory, banana, and grass and ornamental plants, such as Lautalotalo.

2.13 Few native birds and mammals inhabit the Samoa Islands due to the island's relative geographic isolation from continental land masses. Fowls, pigs, the polynesian rats and dogs were introduced by the early Samoan settlers. There are no snakes in American Samoa, but lizards, millipedes, and centipedes are common. The land toad, imported from South America to control mosquitoes and centipedes, is abundant on Tutuila. Insects associated with the warm tropical climate are present on all the islands. Birds are the most abundant form of terrestrial wildlife, but the number of species are limited to approximately 30 species of native birds. The White Collared Kingfisher, the Polynesian Starling, and the Fiji Shrikebill, are included on a preliminary list of endangered birds in American Samoa. A U.S. Fish and Wildlife Service vegetation and wildlife survey of Samoa was recently completed, but the findings have not yet been published. Freshwater animals are uncommon since most of the streams flow only intermittently as in the case of Auasi. The presence of endangered species in freshwater streams on Samoa has not been reported.

2.14 No sensitive wildlife habitats were noted between Cape Fogausa and Cape Matalula, which include the Auasi area, based on a biologic field survey conducted by CH2M Hill in 1974 for a wastewater facilities study in American Samoa (reference No. 3).

Marine Environment.

2.15 Fringing reefs protect much of the shoreline of Tutuila from wave erosion. Freshwater stream discharge often cut channels through reef flats, and rip currents often flow seaward through the channels. Shoreline areas are devoid of living coral reefs where substantial amounts of freshwater flows into the sea and temperature and dessication stresses are high. The shoreline areas are characterized by heavy wave action, low salinity seawater, and rocky shores. Numerous species of reef fish inhabit the reefs and waters surrounding the islands. Numerous invertebrates, such as crabs, lobsters, various mollusks (snails, octopus), sea urchins, and soft or stony corals may also be found on the fringing reef. A variety of marine algae either fleshy or calcareous contributes to the benthic community structure and is important in the basic framework of the reef itself. Beyond the reefs, skipjack and yellowfin tuna are being commercially exploited by foreign fishing vessels which process their catch at two canneries located in Pago Pago Harbor. Marlin, sailfish, and dolphin attract both subsistent and sport fishermen.

2.16 The Auasi area, between Taugamalama Point on the southwest and Maatulaumea Point on the northeast, is fronted by a wide reef flat. The reef has a maximum width of 600 to 700 feet at its center and is somewhat narrower near the southwest side of the natural channel which bisects the reef about 500 feet southwest of Maatalaumea Point. Thus, the reef flat at Auasi can generally be described as consisting of a large southwest sector and a much smaller northeast sector. The natural channel is the major outlet on the reef flat, and currents flowing seaward through the channel are often strong. Other smaller channels were said to have been cut into the back reef areas at Auasi around 1963 to provide a safer land beaching area for longboats carrying people and cargo between Auasi and Aunu'u Island. Only one such cut was evident during the marine ecological survey in 1977. Otherwise, the natural channel is the only navigational passage through the reef providing access to the open sea. The natural channel appears to strongly influence the direction and magnitude of the longshore current on the reef. Nearly all the water on the reef flat is exchanged during each tidal cycle. Water on the reef flat flows toward the channel, then through the channel off the reef. The reef flat is almost entirely exposed during low tide, as a result solar heating of the water results in high ambient water temperatures; a variation of 88-92°F was recorded along the shoreline during low tide by the Bishop Museum (reference No. 8).

2.17 Based on a marine survey of the project area by the Bernice P. Bishop Museum of Honolulu, Hawaii, for the Corps (reference No. 8) the reef fronting the Auasi area can be divided into several zones or biotopes. Five main biotopes were delimited on the Auasi reef area by the Bishop Museum during a marine ecological survey in 1977. These include (1) biotope I, the shoreline consisting of sand and boulders; (2) biotope II consisting of the reef depressions mainly on the inner and the mid-reef flat containing spotty beds of stony corals (facies B) and the rubble areas between 100- and 300-feet offshore covered by collarine algae and exposed at very low tides (facies C), and the mid and outer areas of the reef platform consisting of compact limestone pavement where corals are common (facies D); (3) biotope III, the seaward edge of the reef known as the reef margin; (4) biotope IV, the seaward reef slope below the reef front boundary with developed coral growth and high coral coverage; and (5) biotope V, the natural channel. The reef platform, from the shoreline to the reef margin, exhibits a highly variable distribution of live coral cover. However, the averages for all sampling locations indicated fair cover generally decreasing from 9 to 4 percent over a distance of 0 to 300 feet from shore, gradually increasing to 22 percent at the reef margin, 600 feet from shore. Coral growth is well developed on the seaward reef slope, 600 feet from shore, with live coral covering 60 to 79 percent of the bottom.

2.18 The fish population at Auasi is quite diverse and reflects a broad spectrum of species as expected on the basis of previous surveys in American Samoa. The abundance and diversity of fish increases with distance from shore and amount of coral cover with adult fish becoming more dominant than juveniles. The majority of reef fish on the mid and outer portions of the reef platform are highly dependent on the benthic substratum for concealment and food with only a minority of the wide ranging fish species present. Offshore, on the reef slope, the number of fish species increases while benthic-associated forms decrease. The reef front at Auasi has been characterized by Dr. Richard Wass, fisheries biologist with Government of Samoa, as one of the richest in terms of fish and corals species (117 total species) observed around Tutuila (reference No. 5). Only one other area, Larsen Bay (121 total species), showed a greater number of species; however, Auasi was felt to be highest in both total number of fishes and total fish biomass. The reef front adjacent to Auasi for several miles on either side would expect to be equally rich.

2.19 Subsistence fishing occurs frequently on the reef, especially on the reef margin. Local residents spearfish along the reef front, and night spearing is usually done using a hand-held torch.

Land Use and Cultural Resources.

2.20 Auasi is typical of most coastal populated areas on the island of Tutuila with the exception of Pago Pago. Auasi is a low-density (one-dwelling unit per acre) village located on a valley floor and narrow coastal plain where the highlands meet the sea. There are about a dozen buildings which include a food market with two gasoline pumps. Land use is heavily influenced by physiography and is characterized by extensive exploitation of what little land or marine area and agricultural and marine resources are available. Village expansion is limited by the lack of flat-land area.

2.21 Historically, little information is available for the Auasi area. Auasi is the traditional landing place for persons traveling to and from the offshore island of Aunu'u. A reconnaissance survey of the project area by the Bishop Museum Department of Anthropology revealed no visible archaeological remains or historic sites along the shoreline. The landward limit of the survey area coincided with the edge of the modern road, which by virture of its construction, would have obliterated any traces, if any, of surface archaeological or historic remains. Interrelated with land use is the established practice of re-utilizing stones and coral from abandoned house platforms. As a result, the preservation of older structural remains in American Samoa has been, in many cases, almost nonexistent.

2.22 The Bishop Museum indicated that four traditional land divisions exist in the Auasi area. The land divisions are controlled by different high chiefs. Beginning at Taugamalama Point and proceeding towards Maatulaumea Point, the land divisions are (1) Oloie, (2) Vaovai, (3) Siigavaa, and (4) Vaisa. The area encompassing Taugamalama Point and Oloie has been controlled by High Chief Sigagege, while the inherited title he assumed was in control of Vaovai and Vaisa extending up to the headland on the east side of Auasi. Siigavaa was said to be ruled by the Sa'ole title. Finally, the entire village area of Auasi is said to be owned by the Amouli people. Land title in Samoa traditionally includes the reef platform and fishing rights thereon.

Demographic Characteristics.

2.23 Tutuila is divided into two districts of which Auasi is part of the eastern district. Within this district, Auasi is further contained within Sa'ole County which also includes Aunu'u Island. This county showed the lowest rate of population change between 1960 and 1970 with a population increase from 1,105 to 1,295 (17.2 percent). During the same time, the total eastern district increased 43.3 percent compared to 46 percent for the entire island of Tutuila. The 1970 population of the six villages in Sa'ole County was 378 persons in Alofau, 357 in Amouli, 74 in Auasi, 425 on Aunu'u, 31 in Fogaau, and 30 in Utumea (reference No. 3).

2.24 Although the census shows an overall increase in the population of the territory and Sa'ole County between 1960 and 1970, a breakdown of the data for Sa'ole County shows an approximately 2.5 percent decline in the population of Aunu'u Village from 436 in 1960 to 425 in 1970. All of the villages in Sa'ole County that are located on Tutuila registered an increase in population, while Aunu'u which is isolated from the main island showed a decline. The population decline, which also occured in outlying villages without connecting roads on Tutuila, is attributed to the migration of persons to urban centers on Tutuila (Pago Pago) or leaving Samoa altogether, as well as to inadequate overland and inter-island transportation. The population shift to Pago Pago is of concern to government officials because it is contributing to urban congestion.

2.25 Population projections or the three residential areas nearest Auasi from 1970 to 2010 estimates that Aunu'u will have a population growth of less than 1 percent (400 to 500 persons); Faga'itua, 2.5 percent population increase (900 to 1,400) and Matuli Point, 3.6 percent population increase (1,200 to 2,000, reference No. 4). The projected population increase could reflect high natural birth rates as out-migration has significantly reduced the size of many outlying villages. The population considered to be most affected by the Auasi project is located on Aunu'u Island.

2.26. Socio-Economic Factors. There are about a dozen buildings at Auasi, the majority are western style in construction. A store across from the beach sells mainly imported commodities and also provides two gasoline pumps which are adjacent to the main road. The store, gasoline, cars, television, telephone, water, and electrical power are present and reflect the regional trend toward a cash economy.

2.27 No public sewer facilities exist at Auasi. A building code requires septic tanks for new units. Sewer service is planned for the adjacent villages of Amouli by 1980 and Utumea by 1995. The entire area will have a centrally located treatment plant with deep-ocean disposal at Matuli Point and with a pump station at Auasi after 1980 (reference No. 3). Leaching of sewage into coastal waters from septic tanks has not been investigated at Auasi.

2.28 Recreational activities for the small population at Auasi cannot be easily defined. No centralized facility exists in the village. Children normally seek the company of other village children and play in the general area. Makeshift cricket grounds are sometimes available.

2.29 Coral and basalt rubble from the reef flat and shore have been utilized to build "rock" walls and a simple groin along a portion of the shoreline to prevent erosion near Vaisa Stream.

2.30 There are no supportive records indicating what percent of the people at Auasi commute to other areas for work or school. In 1975, approximately 150 persons commuted between Auasi and Aunu'u Island across the mile-wide strait for work and school on Tutuila. This represents about 30 percent of the entire population on Aunu'u.

2.31 There was no evidence of the existence of local handicrafts or commercial industry at Auasi. Agriculture is evident by the sizeable banana crop planted up on the hillside on the southwest side of Auasi Village. Tourism which is considered an important upcoming industry for Aunu'u is related to Auasi insofar as this village is somewhat of a mainland terminus for any visitor wishing to get to and from Aunu'u. However, access to and from the island is unreliable and infrequent and at the control of the Aunu'u villagers.

2.32 Transportation. The main Tutuila coastal road passes between the shoreline and main village area at Auasi. While government and commercial boats provide occasional transportation between Pago Pago and Aunu'u, travel between Aunu'u and Auasi, or Tutuila is most commonly provided by wooden, oar-powered longboats and outboard-motor boats. With a seven-man crew, a longboat is able to carry 40 children or 20 adults, or up to 2-1/2 tons of cargo. The longboat transportation is time consuming and hazardous especially entering or leaving the shore at Auasi or Aunu'u. Approximately 22 persons have been killed in the last 10 years between the two locations. Furthermore, approximately 25 percent of all transported goods are damaged or lost due to saltwater immersion, spray, and other accidents; a portion (but certainly not all) of which is due to the hazardous landing conditions at Auasi.

SECTION 3

RELATIONSHIP OF THE ALTERNATIVES TO LAND USE PLANS

3. RELATIONSHIP OF THE ALTERNATIVES TO LAND USE PLANS.

3.1 No land use plans or zoning have been established for the Auasi area. The only land use plans in existence in American Samoa involve Government owned lands in Pago Pago Harbor. Two zoning districts have been established in the Pago Pago Harbor area and the Tafuna airport industrial park area. Due to the geographic separation, the project has no obvious conflict with existing land use plans.

3.2 Western land use concepts which regulate land use through government control conflicts with traditional polynesian land use concepts which determine land use through communal agreement and traditional village leaders. Thus, the siting of any plan of improvement must have the consent of village leaders and landowners.

SECTION 4

THE PROBABLE EFFECT OF THE ALTERNATIVES ON THE ENVIRONMENT

4. THE PROBABLE EFFECT OF THE ALTERNATIVES ON THE ENVIRONMENT.

Habitat Modification and Loss

4.1 Each of the alternative plans will modify the reef environment by destroying marine organisms and creating new subtidal habitats and covering existing habitats. Plan 1 destroys 1.2 acres, while Plans 2, 3 and 4 destroy 2.5, 3.2, and 2.3 acres of reef habitat respectively.

4.2 New habitats and exposed surfaces created by construction on the reef platform will be colonized by marine organisms, although the abundance and diversity of organisms will be lower in the dredged areas as compared to the remaining and neighboring reef areas. The fish fauna will be temporarily dominated by transient forms, until biological colonization provides shelter and food for a more diversified and stable benthic community. Fish might be attracted temporarily to the dredged site to feed on organisms stirred up, killed, or exposed by dredging. The entrance channel and boat basin may provide hook and line fishing opportunities by allowing pelagic fish to come closer to shore in the channel and basin.

4.3 Species recovery rate, abundance and productivity could be slow if species recruitment and replacement from surrounding reef areas is low. Construction on the reef will destroy shallow water habitat valuable to fishery resources. The shallow reef platform is normally considered a natural marine organism spawning and nursery area, as the shallow waters protect smaller fish from larger predators. The shallow nursery areas are believed to serve as a source of fish species normally found on the reef front. Areas on the reef devoid of corals or sparsely covered with coral have a variety of algae which contribute extensively to the productivity of the reef. Algal growth supports many edible reef fishes which use nearby corals for shelter, and provides nutrients for invertebrate marine communities on the reef. The release of nutrients from algal decay could be essential in maintaining existing levels of production in coral communities. Plan 1 destroys the smallest amount of habitat and would be expected to exert the least impact in the shallow water reef areas. It may be possible that the dredged portions of the reef and intertidal areas of the breakwaters can serve as eventual spawning /nursery areas by providing shelter to small fish. Algae will colonize the new substrate providing a food source for colonizing organisms. Normal food chain production can still occur on the remaining 90 to 75 percent of the reef flat.

4.4 Blasting may be necessary for each alternative plan and may kill marine life depending upon their location, resistance to the force of shock waves, size of charge, depth of water and substrate characteristics. Corals close to the detonations will be compressed or broken by shock waves. The rich outer reef slope may be subjected to possible fractures and slumping of the framework with the loss of corals in and beyond the immediate project location. The impact of blasting may be reduced by using warning charges to frighten fishes away from blasting areas prior to detonation, using directional charges, by blasting at ebb tide when the reef is exposed or by using other methods to block or interrupt the shock wave. Blasting in the existing channel (Plan 4) will result in coral loss along both sides of the channel, especially where corals are attached to vertical or sloped surfaces. Coral recolonization can be expected in time through recruitment from adjacent areas. Broken or fractured portions of the reef will be cemented by calcified algae, and some live coral will be able to survive and form new colonies.

Water Circulation.

4.5 Water quality in the harbor will influence the recovery rate and composition of the marine environment and will be dependent upon flushing effectiveness which appears to be dependent upon tidal flow and wave energy. While the tidal exchange on the remaining reef flat will remain virtually unchanged, the deep channel and basin areas will not flush as effectively if only the tidal currents are driving water exchange in the deeper areas. If wind, wave and current energy input into the channel and basin can mix the water column, water exchange should be more efficient, particularly in the deeper portions of the channel and harbor basin. Water residence time in the channel and basin will probably be higher for plans which include structural features which protect the basin from wave energy input, alter current patterns and block the wind.

4.6 The harbor plans will alter the flow of water over the reef platform. The dredged areas will serve as alternate pathways for reef water either entering or leaving the reef flat during tidal exchange or because of wave action. The channel and basin plans in the middle of the Auasi reef flat will tend to divide the reef platform into about 3 equal sections rather than the two existing unequal sections, and will probably reduce the velocity and volume of water flowing northeastward on the reef flat. Structures perpendicular to the shoreline will tend to deflect longshore currents. The channels and basins in Plans 1 and 2 will tend to intercept water flowing northeastward toward the existing channel and possibly reduce the amount of flow through the existing channel. Plan 3 will tend to deflect the northeast flow of water southeastward around the causeway or out to the ocean through channel. The 30-inch diameter circulation culverts spaced along the base of the causeway are intended to permit tidal flow under the causeway and to help flush the turning/mooring basin. Plan 3 has the greatest potential for altering currents on the Auasi reef flat. In Plan 4, the breakwater extending out from Maatulauma Point will tend to deflect water moving southward from Maatulauma Point and divert it toward the channel, but water will continue to flow northeastward off the Auasi reef flat into the channel and out into the coastal waters. In Plan 4, the deepening and widening of the existing channel in the reef flat may reduce the velocity of water flow through the channel. Plan 4 represents the least amount of change to currents on the Auasi reef flat. If the longshore currents are presently transporting sand, the channel and basin areas will tend to trap sand suspended in the water by reducing the capacity of currents to move the sand, causing the basin and channel to shoal. Marine organisms reaction to the change in current patterns, flow velocity and volume is difficult to assess.

4.7 Sedimentation and Turbidity.

Dredging and filling will temporarily increase turbidity around the project site, reducing light penetration in the water and creating stressful conditions for photo-synthetic and light sensitive organisms. The magnitude of turbidity and sedimentation stress will depend upon the method of dredging, the amount and size of fine sediment produced and suspended by dredging, and the rate of dispersion and deposition which are dependent upon water currents and wave action. Large particles will settle out within or close to the work areas. Finer and lighter particles will settle more slowly and be dispersed quickly, and are not anticipated to create significant stress problems. Wave action and currents will agitate the deposited material increasing turbidity and creating abrasion stresses. Sedimentation will smother and destroy some coral, and abrasion may damage and destroy others. Smothering stresses will be more apparent in relatively quiet waters, such as depressions where currents cannot flush bottom surfaces. The reef areas which will be most susceptible to turbidity, scour and siltation will be those close to the work site. The plan requiring the least amount of dredging and filling would create the least amount of silting and turbidity stress. However, high velocity longshore currents moving northeast towards the existing channel during high tides suggests that a rapid flushing time can quickly disperse the suspended sediment and turbid waters out into coastal waters away from the rich coral reef areas. Thus, Plan 4 may create the least amount of sedimentation and turbidity stress. Plans 1, 2 and 3 are located in areas of rich coral growth and can be expected to create the greatest amount of sedimentation and turbidity stress. How much sediment settles in the basin and channel will determine whether a silty bottom habitat will develop.

4.8 Effects on Groundwater. None of the alternative plans is likely to tap the basal ground water system since each is located offshore and limited to the reef flat and no excavation is planned on shore.

4.9 Shoreline Erosion. The harbor protective structures will alter the physical forces acting on the shoreline. Breakwater and revetted structures will tend to reflect wave energy even while reducing some of the wave force. The presence of shoreline protection walls and a rock groin along the Auasi shoreline indicates both human encroachment and filling along the shoreline and the presence of existing erosion problems which are pronounced at the mouth of Vaisa Stream. During severe storm periods, large waves could enter the harbor channel and basin and break directly on the shoreline. Rock structures may focus wave energy on the shoreline. The plan which provides shore protection or shoreline revetment and preserves reef flat area in front of the shoreline may have the least potential to induced shoreline erosion.

4.10 Ciguatera. Construction of a harbor will create new surfaces which have been suggested to trigger outbreaks of ciguatera fish poisoning. Recent research has related ciguatoxin to a marine dinoflagellate, Diplopsalis which is speculated to grow on a marine algae. The dinoflagellate may become more prevalent when new surfaces are colonized by algae. It is hypothesized, but not substantiated, that fish eat the algae which contain the dinoflagellate and become toxic. The fish appear unaffected by the toxin, but the fish are toxic to man when eaten. To date, ciguatera outbreaks have not been reported following construction of the Ofu Harbor on Ofu Island in 1976.

4.11 Breakwater, Revetment and Causeway. Breakwaters, revetted moles and causeway construction on the reef platform will crush or cover marine organisms. The plan having the least amount of structural improvements would least damage the marine environment. In terms of area, Plans 3 and 4 each would cover nearly 1 acre of reef flat while Plan 2 would cover about one-half acre. Plan 1 has no protective rock structures. The armor stone will be colonized by intertidal organisms. Crevices formed by the armor rock will provide habitats for cryptic or photophobic organisms. The composition of this benthic life is expected to differ in species diversity and abundance from that of the adjacent reef platform due to the difference in substrate composition, vertical relief and periods of inundation and exposure. The magnitude and duration of environmental stress caused by construction can be lessened by constructing the structures and dredging simultaneously. Similarly, the construction of impermeable revetments prior to filling will reduce erosion of the fill and minimize sedimentation and turbidity stresses to the surrounding reef areas.

4.12 Construction, Mobilization, Storage and Billeting. For the period of construction, heavy equipment and blasting will increase noise and air pollution levels above quiet and relatively pristine ambient conditions. Location of mobilization, storage and billeting areas are subject to approval of village residents, thus should not interfere with village activities or subsistence agriculture. Heavy equipment movement between the work and construction site will create temporary traffic hazards. The possibility of non-Samoans residing in the village may enhance a certain amount of cultural interchange, but may also create a certain amount of cultural friction. These effects, although temporary, can be minimized by proper planning and selection of storage and marshalling areas, and management of traffic, construction and related human activities at the site. Situating marshalling areas as close as possible to the construction site will minimize traffic movement. The use of noise suppression devices conforming to occupational-industrial safety standards and emission control devices will minimize noise/air impacts.

4.13 Quarrying. Quarrying will be done on Tutuila with rock being brought to Auasi from an existing quarry at Mapua or elsewhere. If a new quarry is opened solely for the Auasi project, archaeological and biological studies necessary to evaluate probable effects will be performed and a supplement to this environmental statement prepared as necessary. The use of field stone, talus rock, will eliminate or reduce the need for quarry material.

Tourism and Long-Term Socio-Economic Effects.

4.14 The harbor at Auasi together with Aunu'u Harbor may influence the rate of socio-economic change on the island of Aunu'u, as well as in the village of Auasi, by improving the transportation link between Tutuila Island and Aunu'u Island. However, harbor influences are dependent upon surface transportation between Tutuila and Aunu'u which is presently unreliable and irregular, and which is dependent almost solely upon Aunu'u communal efforts. While the harbors at Auasi and Aunu'u provide navigational and access safety, particularly at the point of landing, the development of regular and reliable transportation service and rights-of-access are solely dependent upon socio-economic factors unrelated to the project. At the present time, the existing trend in American Samoa is toward a cash economy based upon western concepts of gainful employment and away from the traditional subsistence economy based upon conjunal cooperation and agricultural use of the land. At Aunu'u, the village has promoted and encouraged the development of tourism, considered the Territory's greatest potential economic resource, by improving sewage and water systems, setting aside and developing housing accommodations, and working to declare a portion of their island as a Natural Landmark. Regularity and reliability of transportation and right-of-access to Aunu'u appear to be limiting factors which may be slowing the development of tourism on Aunu'u. Other human endeavors such as advertising, providing for basic humanly comforts and entertainment are also needed if tourism is to prosper on Aunu'u. Should tourism become a major source of income on Aunu'u, Auasi may become a point of departure and return for tourist traffic to Aunu'u dependent upon where and how reliable and regular sea transport to and from the offshore island, is developed. Auasi is already easily accessible by road from Pago Pago and is located along the major touring route on Tutuila, however, the village does not have and has not developed any significant tourist attraction.

4.15 Tourism consumes vital resources, such as water and imported or manufactured commodities, and also encourages the commercialism of traditional customs and influences changes in the social structure of indigeneous societies. The rates of change and the kind of change is dependent upon local government and residents. Presently, western technology, cash economies, culture, ideology, schooling and communications has resulted in the subversion of traditional social customs, heirarchy and values with the resultant increase in alcoholism, juvenile delinquency, crime and social conflicts. Traditional housing structures have been replaced by modern western style construction. Increased world travel by Samoans has resulted in an infusion of many new ways of viewing life in American Samoa.

4.16 Navigation safety improvements may encourage a resurgence in agricultural activities on Aunu'u. Aunu'u was said to have been a prime agricultural area producing citrus fruits and taro, and is today the largest producer of wetland taro in American Samoa even though only a small amount of the available wetlands is being utilized. If agricultural activities are enhanced as a result of increased demand because of fast and reliable shipment to local markets, more of the wetland areas on Aunu'u may be developed for taro cultivation resulting in the removal of natural wetland vegetation in the marshes on Aunu'u.

4.17 Harbor Use. Each of the alternative plans will attract boaters to the area resulting in an increase in the number of boaters utilizing the reef area at or around Auasi. However, much is dependent upon the ability of local Samoans to purchase, own and operate trailered or untrailered, motor or unpowered boats. At the present time, most boats are utilized by Samoans for fishing or transporting goods and people with use confined to specific localities. Government agencies and contract government workers presently have the resources to own and operate trailerized or portable motor boats. The establishment of a SCUBA club in American Samoa and an Office of Marine Resources suggest that new cultural concepts and technology concerning utilization of reef resources are evolving. Exploitation of reef resources off Auasi is also dependent upon village attitudes toward intrusion upon traditional fishing areas. Should the number of motor boats operating out of Auasi increase, air, noise and water pollution resulting from boating activities would be expected to increase proportionally. Because the harbor provides minimal protection, boats will not be able to be moored permanently in the harbor and would have to be removed during storms. Potential damage to the coral reef resulting from boating activities would include anchoring damage, prop wash stirring up sediment, petro-chemical pollution, littering, and possible groundings. Engine noise and vibrations may scare fish, but the harbor may also provide a refuge for some species. Local awareness and periodic surveillance and maintenance by local authorities are factors affecting petro-chemical pollution and littering, and boating activities in general.

4.18 Temporary Equipment Causeway. Construction and removal of equipment causeways will destroy habitats and kill marine life on the sea bottom and contribute to an increase in turbidity due to erosion of the causeway. To minimize these effects, the causeways could be placed within the center of areas to be dredged or filled, reducing the amount of marine habitat disturbed, and could be constructed using large boulders instead of coralline or terrigenous aggregate or fill, lessening erosion and associated turbidity and sedimentation stresses.

4.19 Maintenance Dredging. These requirements will periodically disturb marine organisms which will colonize the harbor bottom and will temporarily increase turbidity within the small boat facility once every five to ten years. The Government of American Samoa will be required to make the arrangements for a disposal land site. Due to the lack of evidence of any major influx of terrigenous material into the marine environment or lack of terrigenous deposits on the reef flat in the central platform area, the bulk of the dredged material is expected to be calcareous. However, there is a scattering of basaltic boulders eroded from the Maatulaumea headland on the surface of the reef flat, the site of harbor Plan 4. The revetted shoreline in Plan 4 will prevent erosion and deposition of any shoreline material into the harbor channel or basin.

Effects on Wetlands or Submerged Lands.

4.20 Dredging and filling on a portion of the Auasi reef flat does not permanently alter food chain production in the coastal marine environment, however, localized changes specific to the harbor site will result in a reduction in species abundance and diversity, in reef subsistence fishing and foraging area, and in shallow water habitat used by marine organisms as a breeding and nursery habitat. New fishing opportunities will be provided by the harbor as pelagic fishes will have an opportunity to come closer to shore in the harbor channel and basin and as fishing from the harbor protective structures and docking facilities will most likely occur. Marine organisms will colonize the harbor, but specie abundance and diversity in the harbor is expected to be lower than the surrounding reef areas. Colonization of the breakwater and revetments may increase species diversity at a particular location in the harbor, however, species abundance is expected to be lower than on the reef.

4.21 The harbor channel, basin and structures are expected to alter current patterns on the reef flat and acting on the shoreline. Flushing characteristics on the reef flat will not be altered, however, water residence time in the harbor is expected to increase. Harbor construction is not expected to tap basal waters systems and later salinity distribution on the reef flat. The project will not alter or modify tributaries entering the nearshore marine environment, thus should not alter sedimentation patterns on the reef flat. However, the harbor construction may create a silty harbor bottom environment, and the harbor basin and channel may shoal, reflecting a change to the existing conditions. The project will not affect upland drainage.

4.22 The project will not affect upland storm or flood water storage. While the integrity of the reef as a barrier zone to the Auasi shoreline is maintained, dredging on reef flat will alter physical oceanic regimes on the reef flat, i.e., the deeper channel and basin may allow large waves to act on the shoreline. The breakwaters and revetments will reflect wave energy and may alter the direction of wave action along the shoreline. The project will not affect potable ground water resources.

4.23 The project will not affect any properties listed as a national wild and scenic river, park, wilderness area, shoreline, lake, monument landmark, or historic place. Species listed as endangered, nor critical habitat area for endangered species or marine sanctuaries will not be affected by the project.

4.24 The project will not require any ocean disposal of dredged material. All excess dredged material will be stockpiled on land at a site to be determined by the Government of American Samoa and village leaders.

SECTION 5

ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

5. ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED.

5.1 Harbor construction will result in reef habitat loss varying between 1.2 and 3.2 acres; an amount equal to 10 to 25 percent of the reef surface. Marine organisms will be destroyed within the dredged and filled areas and there will be reduction in fish/nursery and reef foraging and fishing areas. The loss should not affect total population and recuperative abilities of any particular species, but will result in a change in ecosystem and species composition within the affected areas. New fishing opportunities within the harbor may be realized as pelagic reef fish will have an environment in which they can move closer to shore. Marine organisms can be expected to colonize the hard surfaces of the dredged areas as well as the intertidal surfaces of breakwaters and revetments. The difference between the newly created subtidal habitats and those of the existing natural channel will depend, in the long-term, upon the water exchange and circulation patterns. Temporary increases in sedimentation and turbidity will be experienced during dredge and fill operation. Turbid plumes are expected to be dispersed quickly because of the openness of the area to the ocean. Shoreline erosion adjacent to the project site in Plans 1, 2, and 3 suggests that construction in this central area at Auasi could influence shoreline erosion by altering oceanographic factors. Revetting the shoreline and preserving shallow water reef area fronting the shoreline will provide protection to the shoreline. Dredging of the entrance channel will alter currents on the reef flat. Plan 4 will alter the configuration of the natural channel and inshore northeastern reef area by widening and deepening the existing channel and will also alter currents in the channel.

5.2 The harbor will not displace any people and will improve navigational safety at the Auasi landing and launching site. The harbor will help to protect human lives and property and will not have any direct adverse effect upon human resources. However, specific actions related to establishing modes and frequencies of travel between Aunu'u and Auasi may result in localized socio-economic changes to existing conditions at Auasi and Aunu'u. Tourism could become a major source of local income possibly resulting in an erosion of traditional cultural values and customs. Agricultural activities may expand with an increase in reliability of produce transportation to market. The out-migration or decline of village population at Aunu'u may be attenuated with improved means of transportation and increase in safety.

SECTION 6

ALTERNATIVES CONSIDERED

6. ALTERNATIVES CONSIDERED.

6.1 No Action. The alternative means no action by anyone or any government to improve navigational safety at Auasi. The alternative would result in no change to the reef environment by dredging or filling in conjunction with navigational improvements. Commuter traffic would continue to traverse the strait and to encounter the navigational hazards discussed earlier. Tourism potential on Aunu'u will continue to be limited by the availability and regularity of surface transport from Pago Pago and commuter boats from Auasi. The import and transportation of commercial bulk items and large quantities of commodities would be handled by boat directly from Pago Pago once the Aunu'u Harbor is completed, but a variety of smaller commodities would continue to be transported by commuter boats from Auasi. The navigational hazards of landing at Auasi would continue to pose a threat to human lives and property. The continued threat to and possible loss of human lives and property did not meet planning objectives to improve navigational safety, and some sort of action was considered to be necessary.

6.2 Increased Use of Motorized Boats. Motorized boats may be presently replacing oar-powered longboats as common means of providing commuter service. The motorized boats improve navigational safety through rough waters by eliminating the hazards and problems of seamanship now dependent upon coordinated group rowing. However, problems could still occur within the reef surf zone where the shallow waters prevent the operation of the motor and require the use of manpower to maintain the direction and stability of the boat. While the initial purchase, maintenance and operation costs for a motorized boat may be prohibitive to the common individual, communal purchasing power may be able to acquire motorized boats over a period of time, if nothing is done by the government. The alternative does not increase navigational safety at Auasi, but may improve sea worthiness of boats presently providing the commuter service.

6.3 Improve Boat Transportation From Aunu'u to Pago Pago. The majority of commuters from Aunu'u travel to Pago Pago for work, for school, and to buy or sell goods and produce at the market. The present trip by boat from Aunu'u to Auasi and then by aiga bus to Pago Pago is approximately 17 miles taking up to an hour or longer to complete. If boat transportation service could be improved from Aunu'u directly to Pago Pago and return, the commuter distance would be 8 miles, however, the time required to commute would not be reduced due to the slowness of boat travel. The alternative would preserve the reef at Auasi from dredge and fill damage resulting from harbor construction activities. Tourism activities on Aunu'u could increase with better availability and regularity of boat transportation. If tourism becomes a major economic factor on Aunu'u, social contact between villages of Aunu'u and Auasi would be disrupted and may result in a loss of local trade and income as the flow of people through Auasi would decline. While improved boat transportation directly between Aunu'u and Pago Pago may help to reduce navigational hazards at Auasi, some commuters would continue to traverse the strait for school and to trade in the coastal areas between Auasi and Pago Pago. These commuters would continue to be subjected to navigational hazards presently experienced at Auasi. For these individuals improvement to navigational safety was considered desirable.

6.4 The implementation of the alternative would be responsibility of the local government. Problems with implementation involve the lack of the availability of vessels to maintain regular commuter service between Aunu'u and Pago Pago at reasonable cost. Commuters presently travel between Aunu'u and Pago Pago for the price of aiga bus fare with the cost of the boat being reduced by communal cooperation and manpower. The Government of American Samoa may not be able to operate a non-profit transportation service without additional US subsidy.

6.5 Bridge. A bridge between Auasi and Aunu'u could probably provide a quick ground transportation link between Aunu'u and Auasi except during violent weather conditions. However, constructing a bridge over one mile distance in water depths up to 240 feet will be difficult engineering-wise and cost prohibitive. The bridge would be susceptible to hurricane damage and require maintenance.

6.6 Relocating the People on Aunu'u. The landing at Auasi is mainly a hazard to the people on Aunu'u Island. If the people were relocated from the island to a location on Tutuila, the hazard would no longer exist. The alternative is considered socially unacceptable both to the government who must find lands and homes for the displaced villagers and the Aunu'u villagers. The Samoan society places high values on traditional land ownership and communal life-styles, and the displacement of the people of Aunu'u to Tutuila Island would create unresolvable hardships for the people of Aunu'u who own Aunu'u Island, and for the people of the areas to where the Aunu'u people would be moved.

SECTION 7

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY.

7.1 The harbor would serve the immediate and long-term need for a safe, more efficient and convenient commuter landing and temporary moorage for commuters traveling between the Tutuila mainland and Aunu'u Island. Between 1.2 and 3.2 acres of reef habitat would be altered depending upon the plan adopted with a resulting reduction in subsistence reef foraging and shallow water nursery and breeding areas. The channel, basin and protective structures may provide new fishing opportunities. The harbor may stimulate agricultural production on Aunu'u by increasing market transportation convenience and safety provided boat services are improved. A new marine ecosystem will be created in the channel and boat basin that will be lower in species diversity and abundance than the remaining reef habitats at Auasi. The reduction in reef flat area for spawning or nursing, as well as potential food supply for juvenile or herbivorous organisms, may result in the long-term reduction and replacement of species on the reef front if similar recruits and resources from adjoining reef areas are not available.

7.2 The harbor will complement the local government plans to enhance and improve the territory's economic and agricultural programs to encourage population stability and to improve intraterritorial travel between Aunu'u and Tutuila. The role the harbor will play in contributing or altering the socio-economic trends and intrinsic cultural values is dependent upon many factors, one being the development of reliable, frequent and scheduled boat service between Tutuila and Aunu'u.

SECTION 8

ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES WHICH WOULD BE INVOLVED SHOULD THE ALTERNATIVES BE IMPLEMENTED

8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES WHICH WOULD BE INVOLVED SHOULD THE ALTERNATIVES BE IMPLEMENTED.

8.1 All the plans requires the commitment of existing and future money, human labor and fuel resources. Plan 1 alters approximately 1.2 acres of reef habitat and destroys associated shallow water and reef organisms. Similarly, Plan 2 alters 2.5 acres of reef habitat. Plan 3 alters 3.2 acres and Plan 4 alters 2.3 acres. The loss of shallow water reef foraging area has an unquantifiable effect on subsistence fishing opportunities. In addition, Plans 2, 3 and 4 will each require several thousand cubic yards of rock material.

SECTION 9

COORDINATION, COMMENT AND RESPONSE

9. COORDINATION, COMMENT AND RESPONSE.

9.1 Coordination. The development of the project alternatives was a result of coordination with the Auasi and Aunu'u village chiefs who indicated their desire for a harbor on the reef flat, and the Government of American Samoa who had initiated the project request, provided some planning data and aided in developing planning objectives. The US Fish and Wildlife Service, National Marine Fisheries Service and the Environmental Protection Agency were notified of the detailed studies in December 1976. The Detailed Project Report will be sent to the above individuals and agencies for review and comment. In addition, this draft environmental statement will be sent for comment and review to the following government agencies and interested parties.

US Department of Agriculture
US Department of Commerce
US Department of the Interior
US Environmental Protection Agency
US Department of Health, Education and Welfare
US Department of Transportation
US Department of Housing and Urban Development
Government of American Samoa
Government of American Samoa, Department of Public Works
Office of the Governor, Environmental Coordinator
Village chiefs of Aunu'u and Auasi

9.2 A public hearing is scheduled for October 1977.

APPENDIX A

SUMMARY OF ALTERNATIVE COSTS

APPENDIX A

SUMMARY OF ALTERNATIVE COSTS

		Plan 1	Plan 2	Plan 3	Plan 4
1.	Estimated First Costs	$360,000	$620,000	$680,000	$510,000
	% Federal Costs	335,000	555,000	575,000	435,000
	% Non-Federal Costs	25,000	65,000	105,000	75,000
2.	Average Annual Costs (includes maintenance costs)	26,500	47,000	52,000	39,000
3.	Total Average Annual Benefits	40,000	59,900	60,400	58,900
	Transit Time Savings	8,700	13,000	13,000	13,000
	Loss Wages	26,200	39,400	39,400	39,400
	Fishing 1/	1,800	1,800	1,800	1,800
	EDA 2/	3,300	5,700	6,200	4,700
4.	Benefit to Cost Ratio	1.5	1.2	1.2	1.5
5.	Other Information				
	Maintenance Cost 3/	1,500	4,000	5,000	4,000

6. Benefit-cost analysis does not include either the loss of marine resources, which include reef foraging area, nursery area and individual organisms or the difference in fishing opportunities and safety of human lives.

Note: Economic data extracted from the Draft Detailed Project Report, Aunu'u Harbor, Auasi, Tutuila Island, American Samoa, prepared by the US Army Engineer District, Honolulu.

1/ Some commercial fishing will be realized as future project benefits, but data is insufficient to quantify potential added benefits.

2/ EDA benefits derived from employment of local labor resources.

3/ Maintenance costs are estimated on maintenance work required once every 5-10 years.

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